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THE TREATMENT OF SHOCK IN THE FIELD.

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THIS paper deals with the treatment of shock in wounded soldiers. It deals with shock occurring in young, healthy men as a result of extensive tissue injury and associated hæmorrhage. This type of shock has been variously named, but can be most clearly defined as shock from trauma and hæmorrhage.

From July, 1940, to the present time I was resuscitation officer to an Australian field ambulance, and treated patients suffering from shock under all conditions of desert warfare. Until August, 1942, I used the routine army blood transfusion method, but was not satisfied with the results obtained; too many patients did not respond to this treatment, despite apparently adequate transfusion. The day of the standard "pint transfusion" is long passed, it being generally recognized that the volume of blood given to any patient must vary with the severity of the shock; however, nowhere in the literature on shock is a method described by which the volume of blood required by a patient suffering from shock can be computed in the field. In recent literature rapid blood transfusion is advocated; it is realized that the response to transfusion varies with the rate of transfusion, but nowhere can a statement be found of the optimum speed of transfusion for all grades of shock. The medical officer has only broad principles to guide him, the efficiency of his treatment depending on his own experience. Frequently a patient suffering from shock is treated by blood transfusion given at drip rate hour after hour, the only factors that govern the volume or speed of transfusion being death, a blocked needle, or obvious recovery. It is essential that there shall be some definite standards to govern the volume and the speed of blood transfusion in any case. I have attempted in this paper to define these standards.

In August, 1942, I evolved a method of classification for the grades of severity of shock, and for each grade I estimated the volume of blood required and the speed at which it was to be given. I knew that within the next few months I should have the opportunity of confirming these standards.

I was fortunate in having working with me six orderlies who were highly trained in transfusion work, and in having the services of an accurate clerk; during August, 1942, these men were instructed in the new method of treatment, and in the method of recording.

A record was to be kept of all patients treated, and by analysis of these records it was hoped to make the following determinations: (i) the accuracy and practical value of the method of classification used; (ii) the average (standard) volume of blood and serum required for the treatment of each grade of shock; (iii) the optimum (standard) rate of transfusion for each grade of shock; (iv) the frequency, character and severity of complications of transfusion; (v) the frequency, character and cause of reactions during transfusion; (vi) the prognosis in traumatic shock; (vii) the cause of death of all shock patients who died at the main dressing station.

The investigation was carried out from September 1, 1942, to November 4, 1942, at a main dressing station at El Alamein.

The main dressing station was situated about nine miles from the front line; the roads were poor. The majority of patients were admitted during the battle of El Alamein. In quiet times most patients were admitted about four hours after being wounded; during the battle the majority were in the eight to twelve hour period; but in the later stages, when the front moved forward, some had been wounded eighteen to twenty-four hours previously. The casualty clearing station was four hours distant over a good road. The policy at the main dressing station was to admit to the resuscitation ward all patients suffering from shock, the only exceptions being those with head wounds uncomplicated by any other injury and not associated with hæmorrhage. Two surgical teams were

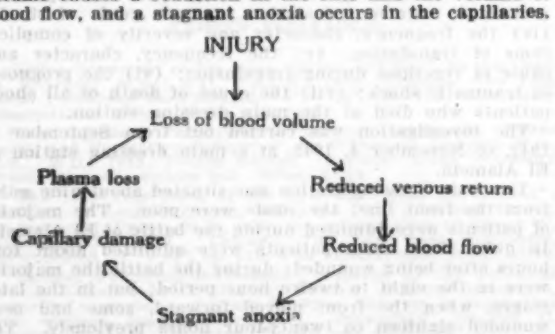
operating, an attached team from an Australian general hospital and the unit team. The surgical policy was that all life-saving surgical work should be carried out, including attention to all compound fractures and all abdominal wounds. From September 1 to November 4, 1942, 1,600 battle casualties were treated at the main dressing station; 252 patients were admitted to the resuscitation ward, and of them 150 were given transfusions.

Very few of the men treated were aged over thirty-two years. Only four men were suffering from a complicating medical disease; one of them had infective hepatitis and three of them had clinical dysentery. The men were ideal patients mentally as well as physically; they accepted treatment gratefully, bore pain with great fortitude and were not fearful of the outcome. The weather over the whole period was mild; the days were warm to hot, the nights were cold, but not freezing. A dust-laden wind or a heavy dust cloud was present over the battle-field all the time.

Causation and Mechanism of Shock.

The hypothesis of the cause and mechanism of traumatic shock, upon which was based the method of resuscitation used, is a modification of Blalock's[1][2] theory of shock. I have modified it to suit the apparent physiological changes occurring in young, healthy men.

Traumatic shock is initiated by an injury. At the site of injury there is a rapid loss of fluid from the injured vessels and tissues. The fluid loss may be due to external hæmorrhage, to hæmorrhage into the injured tissues or to extravasation of plasma from and into the injured tissues. It is usually due to a combination of all these factors. This rapid fluid loss decreases the blood volume and so decreases the venous return. Decreased filling of the right auricle results in a reflex general vasoconstriction. Reduction in the vascular field is accompanied by an emptying of all blood storage depots. This is an efficient compensatory mechanism, as the effective blood volume is enlarged both by the decrease in the vascular field and by the utilization of all the blood available in the body. In a young, healthy man this mechanism can compensate for the rapid loss of over 1,000 cubic centimetres of blood without any circulatory failure. If the loss of fluid is stopped at this stage, the blood volume returns to normal by an inflow of extravascular tissue fluid. If the loss of blood and plasma continues, a progressive fall in blood volume occurs which cannot be compensated, and the circulation fails. The volume of blood or plasma necessary to cause a breakdown in the compensatory mechanism varies with rate of loss. If the loss is slow, a very large volume can be lost without breakdown of this mechanism, as the lost fluid is being continuously made up from the tissues; but a rapid loss of 1,500 cubic centimetres of the blood volume cannot be compensated. A decrease in blood volume causes a reduction in the rate and the volume of blood flow, and a stagnant anoxia occurs in the capillaries.



As a result of this the cells of the capillary wall are damaged and lose their function. The capillaries dilate and their permeability is vastly increased, so that plasma is rapidly lost to the tissues through the damaged capillary walls. This leads to an ever-increasing loss of blood volume, a rapid diminution in venous return, an increasing hæmoconcentration, falling blood pressure and rapid failure of the circulation.

This condition may be represented diagrammatically:

Many secondary effects occur from the failing circulation (Schnedorf and Orr[3]). Stagnant anoxia of the capillaries of the respiratory centre leads to rapid, shallow respirations, which are ineffective, and an anoxic anoxæmia is added. Anoxæmia decreases the pressor reflexes from the carotid sinus and further lowers the blood pressure. Unless this cycle is broken, the patient dies.

Prolonged anoxæmia causes irreversible damage to the tissues, nervous tissues being damaged most rapidly and heavily. Death occurs in both treated and untreated cases from failure of the respiratory centre.

Aggravation of Shock.

Various factors play an important part in increasing shock.

Hæmorrhage.—Traumatic shock is usually initiated by hæmorrhage, and for patients with correspondingly severe wounds the degree of shock is usually proportional to the volume of blood lost. Hæmorrhage, besides reducing blood volume and so giving rise to stagnant anoxia, also produces anæmic anoxia.

2. *Pain.*—Severe pain plays a large part in maintaining and increasing shock. That bombardment of the higher centres with painful stimuli should increase shock seems reasonable; the actual mechanism is obscure.

Cold.—Extreme cold produces a further reduction in blood volume (Best and Taylor[4]) and causes further tissue damage, so cold would be expected to increase shock.

4. *Heat.*—Heat causes sweating and dilatation of skin vessels (Blalock[2]). Sweating increases the dehydration of the shocked patient; dilatation of the skin vessels increases the vascular field and so further decreases the effective blood volume.

5. *Dehydration.*—Blood and plasma loss from a wound, and the sweating and vomiting of shock, make dehydration a constant factor to be considered in the treatment of wounded men. Any shortage of drinking water before or after reception of the wounds produces dehydration, which greatly increases shock. A man with a relatively minor wound who is left exposed for a long period without adequate drinking water can be reduced through dehydration to a condition clinically indistinguishable from severe shock.

6. *Toxæmia from Infection.*—Toxæmia damages the vascular endothelium and so causes a predisposition to or increases the capillary damage of shock.

7. *Morphine.*—The respiratory centre is already depressed in shock from prolonged anoxæmia; massive doses of morphine dangerously increase this depression.

8. *Anæsthesia.*—Anæsthesia depresses the vital centres, and any anæsthetic agent given to a severely shocked patient usually has fatal results. Cyanosis during anæsthesia is extremely dangerous to the recently resuscitated patient. His vascular system and tissues have just been recovered from a prolonged anoxæmia; cyanosis which would be regarded as relatively harmless to a patient not suffering from shock will rapidly produce severe shock in a recently resuscitated patient.

Some of the factors played little part in this series of cases. As the weather was mild, cold and heat were not important in increasing shock. Dehydration was not considered an important factor, because the water ration was liberal, none of the men were thirsty before being wounded. The mild weather did not cause sweating, and the majority of the casualties were admitted to the main dressing station within eight hours of being wounded; copious drinks were given at the regimental aid post, during ambulance transport and at staging posts.

No patient was seen in whom toxæmia from infection had increased shock, or in whom toxæmia delayed response to resuscitation. This was due to the short time interval between reception of the wound and treatment.

METHOD OF RESUSCITATION.

The method of resuscitation used was planned to combat, as far as possible, all the causative factors of traumatic shock, and to prevent contributing factors from assuming importance.

In the discussion of the routine method of resuscitation, general measures will be considered first; but in the actual treatment of patients suffering from severe shock, early, rapid transfusion was the first consideration after arrest of hæmorrhage.

Arrest of Hæmorrhage.

Continued hæmorrhage, even at drip rate, is the most potent single factor in increasing shock. It is essential that all hæmorrhage be stopped if resuscitation measures are to be successful.

If hæmorrhage cannot be stopped, then massive, very rapid blood transfusion must be given by two veins until the systolic blood pressure rises to over 100 millimetres of mercury. Operation must then be performed at the earliest possible moment. As soon as hæmorrhage is arrested at operation, a normal response to blood transfusion follows. Four conditions are commonly stated to cause failure of response to resuscitation; they are (*a*) hæmorrhage, (*b*) irreversible tissue damage from prolonged anoxæmia, (*c*) toxæmia from infection and (*d*) fat embolism. Of these, by far the most common is continued hæmorrhage. I am sure that many casualties have been abandoned as suffering from irreversible tissue damage, when in fact they were suffering from continued hæmorrhage. Hæmorrhage is easy to overlook when a patient with multiple wounds is lying on a stretcher in a pool of blood. Lack of response to resuscitation follows exactly the same course in the case of a hæmorrhaging patient as in that of a patient whose tissues have been irreversibly damaged by prolonged anoxæmia. When hæmorrhage is stopped, the response appears magical.

Posture.

All patients when admitted to the resuscitation ward were placed on stretchers with the foot raised six inches; the foot was raised 12 to 18 inches in severe cases. This was done to increase the venous return from the legs and abdomen, and to raise the cerebral blood pressure as much as possible. It is of urgent importance to overcome the stagnant anoxia of the cerebral circulation.

Warmth.

All patients when admitted to the resuscitation ward had cold, clammy skin and a subnormal temperature. Four felt frozen; they had been lying outside for twelve hours on a very cold night. Because of the danger of overheating, hot-water bags alone were used for warming them, and these were removed as soon as the patient's skin was warm and his temperature had returned to normal. Every effort was made to avoid sweating. A stretcher with warmed blankets was prepared for patients after operation. The roasting of shocked patients over "Primus" stoves or oil heaters is very dangerous; overheating with consequent sweating and dilatation of skin vessels is to be strenuously avoided in the treatment of shock.

Morphine.

The dose of morphine administered to patients by regimental medical officers was usually one-quarter of a grain given subcutaneously in the average case, and five-eighths of a grain given subcutaneously in severe cases. The patients were admitted to the resuscitation ward about four hours later. The circulation in the subcutaneous tissues of a patient suffering from shock is very poor. Morphine given subcutaneously after the onset of shock has little effect, the flow of plasma from the capillaries preventing entry of the injected material into the circulation. The danger is that, as the first injection gives no relief, further injections will be given and these will have no effect until shock has been overcome, when a huge dose of morphine will flood the respiratory centre. This occurred in two cases of this series and necessitated repeated injections of "Coramine", the administration of "Carbogen" and some artificial respiration before the patients were out of danger.

Morphine must be given to shocked patients only when they complain of pain; this excludes the vast majority of patients suffering from severe shock, as they feel no pain until they have practically recovered.

If morphine has to be given to a patient with established shock, it should be given intravenously. The intravenous injection of one-quarter of a grain will give rapid relief of pain, the maximum effect lasting about thirty minutes. In this series the injection was given slowly into the transfusion tubing near the intravenous needle.

Morphine given intravenously produces an immediate physiological action, and no cumulative effect can operate from the site of injection. At El Alamein no ill effects were observed from its use. Patients with shattered limbs to which a tourniquet had been applied, and those with penetrating wounds of the abdomen involving the small bowel, frequently could not be relieved of their pain. It was found that in these cases the response to resuscitation was delayed. They were operated on as soon as possible after the systolic blood pressure had reached 100 millimetres of mercury. Full anæsthesia was followed by a rapid rise of the blood pressure to normal.

Drinks.

Copious drinks were given to all patients. Although dehydration was considered to play little part in the production of shock in this series, all patients suffering from shock must have lost a large volume of fluid. All men when admitted to the resuscitation ward felt thirsty, and extreme thirst was common; warm, sweetened tea containing half a teaspoonful of salt to the pint was given. The men were encouraged to drink up to a quarter of an hour before their operation. Vomiting during the resuscitation period was not usual; it occurred in about 30% of all cases, and it was of projectile type and was usually repeated once or twice. Continuous vomiting occurred only in the presence of penetrating wounds of the abdomen, and any type of vomiting always led to reexamination to exclude intraabdominal injury.

Oxygen.

Irreversible tissue damage occurs in shock from prolonged anoxæmia. In severe shock the oxygen-carrying capacity of the blood in effective circulation must be used to a maximum while the blood volume is being rapidly increased by transfusions.

In this series oxygen was given to severely shocked patients. "B-L-B" inhalation apparatus was used with nasal masks and good flowmeters. Oxygen was given at the rate of eight litres per minute for about thirty minutes, and the rate was then gradually reduced to five litres per minute. Its administration was continued until the patient's colour was good and his respirations were normal. The total period of administration was about one hour.

The patient's colour improved and his respiratory rate fell immediately oxygen therapy was started. The effect on the blood pressure could not be estimated, as oxygen was always given concurrently with the blood transfusion. Oxygen was also given during and after operation, at the first sign of cyanosis. With the exception of hæmorrhage, there is no more potent factor in the lowering of blood pressure than cyanosis. It was frequently found that if cyanosis developed, either during operation or in the immediate post-operative period, the blood pressure fell despite continued transfusion. A rapid rise to normal followed when the cyanosis was overcome by oxygen therapy.

Intravenous Administration of Fluid.

Traumatic shock is initiated by diminution of blood volume and established shock results in further diminution of blood volume.

To be successful, the treatment of established traumatic shock must break the vicious cycle of diminution of blood volume, failure of venous return, failure of the circulation,

stagnant anoxia, capillary damage and further reduction in blood volume by plasma leakage. This cycle must be broken before irreparable damage from prolonged anoxæmia is done to the tissues. It is an emergency condition, requiring prompt, energetic and adequate treatment. The only possible method of recovering the severely shocked patient is to increase the blood volume sufficiently for the circulation to return to normal before any severe damage has been done.

The blood volume has been reduced by loss of blood and plasma; the ideal fluids to replace this loss are blood, plasma and serum. Crystalloid solutions give a transient increase in the blood volume, but in established shock they are rapidly lost to the tissues from the dilated permeable capillaries. Colloid solutions, such as blood, plasma and serum, are retained in the vessels for a longer period; but they also are lost steadily until the circulation improves sufficiently for the capillary endothelium to recover its normal function. It is essential that the blood, serum or plasma be given as soon as possible, and that the rate of transfusion be as rapid as possible, for the following reasons.

1. The time factor is all-important in averting irreparable damage to tissues; the longer the patient is left with an ineffective circulation, the greater is the damage done to the tissues and the less are the chances of recovery.

2. Until the circulation is effective, fluid will continue to be lost from the capillaries. If fluid is given slowly, it will no more than make up this constant loss. This is not enough; blood volume must be restored.

Volume of Fluid Required Intravenously.

General considerations give a lead to the volume of fluid given intravenously that is necessary in the treatment of severe traumatic shock. To initiate traumatic shock in a young, healthy man under conditions such as prevailed for this series, a rapid loss of at least 1,500 cubic centimetres of blood and plasma is necessary. (A rapid loss of 30% of the blood volume is said to be necessary to produce shock in a young, healthy man, according to Best and Taylor; but this percentage seems to me to be rather high for battle casualties.) After the initial loss, the falling blood pressure and failure of the circulation slow the rate of loss; it is further slowed by first-aid treatment, which puts the injured part at rest and stops hæmorrhage. However, once shock is established, there is a constant reduction of blood volume through seeping of plasma to the tissues. The majority of soldiers in this series had been wounded six to eight hours before they reached the resuscitation ward. In this period each patient must have lost at least a further 1,000 cubic centimetres of blood and plasma; until a normal circulation was reestablished, he continued to lose fluid from the capillaries to the tissues; while he was awaiting operation there was a constant loss into and from the damaged tissues; and during operation some blood loss was unavoidable—a further 500 cubic centimetres were probably lost in this manner. The total reduction in blood volume in a severe case of traumatic shock was therefore about 3,000 cubic centimetres. Any severe hæmorrhage during the pre-operative or operative periods must be added to this figure. Patients exhibiting less severe shock must be considered to have lost a correspondingly smaller proportion of their blood volume.

Speed of Transfusion.

Adequate speed of transfusion is as important as an adequate volume of blood or plasma given by transfusion. The normal cardiac output per beat (stroke volume) is 60 to 70 cubic centimetres (Best and Taylor[3]). It is possible to give blood at the rate of 500 cubic centimetres in two and a half minutes by using two veins. If the patient has a pulse rate of 100 per minute, this means that cardiac filling is increased by two cubic centimetres per beat. This is the maximum rate of transfusion with available apparatus, and it cannot cause any cardiac embarrassment to a patient with a reduced venous return. A patient suffering from severe traumatic shock has lost 2,500 cubic centimetres of his blood six to eight hours after being wounded; 1,000 cubic centimetres of this must be replaced as rapidly as possible; this will give him a blood volume of about 5,000 cubic centimetres. (The average soldier's blood volume is about 6,500 cubic centimetres, according to Best and Taylor[3]). A blood volume of 5,000 cubic centimetres should be sufficient to allow the beginning of a return to normal. The next 1,000 cubic centimetres can be given over a period of one hour to assist and to stabilize this improvement. The final 1,000 cubic centimetres should be given as indicated during the pre-operative, operative and immediate post-operative periods. Less severely shocked patients with smaller reductions in blood volume respond satisfactorily to smaller volumes of fluid given more slowly.

Method of Classification of Patients Suffering from Shock.

The reduction in blood volume in any patient can be estimated in the field only from the degree of shock. Hæmatocrit readings and the "falling drop" method of estimating the total plasma protein content are impracticable when patients suffering from shock are being treated forward of well-equipped and well-staffed hospitals. Hæmoglobin readings can be made, but they are of no value as a guide to blood volume. For an accurate estimation of the degree of shock, it is essential to take the blood pressure; there is no other accurate guide to the degree of circulatory failure present. The pulse rate is most misleading. A pulse rate of 100 per minute may occur in any grade of shock. Estimations of the blood pressure from the "feel" of the pulse are highly inaccurate. The blood pressure reading cannot, however, be accepted as an infallible guide to the presence of shock. The patient's compensatory mechanism may be so efficient as to maintain a systolic blood pressure of 110 millimetres of mercury or higher, when a large reduction in blood volume has occurred and hæmoconcentration has started. These cases can be distinguished from those in which shock is not present by clinical examination and by repeated blood pressure readings. Once the compensatory mechanism has broken down, blood pressure readings must be an accurate guide to the degree of shock, as they are an exact measure of the degree of failure of the circulation. All patients suffering from shock, when admitted to hospital, present the typical clinical picture, which varies only in degree. They are cold and sweating, pale and slightly cyanosed, and restless, with rapid, shallow respirations and a rapid, small pulse. If such a patient has a systolic blood pressure above 90 millimetres of mercury, then his compensatory mechanism is just beginning to break down, his "vital" centres have suffered no great damage, he is easily recoverable and is a case of "mild" shock. The total reduction in his blood volume is probably not more than 1,500 cubic centimetres. A patient with a similar clinical picture, but a systolic blood pressure between 60 and 90 millimetres of mercury, is suffering from circulatory failure; he has stagnant anoxia and damaged capillaries, and has lost about 2,000 cubic centimetres of his blood volume. He is suffering from "medium" shock. Patients with a systolic blood pressure below 60 millimetres of mercury are "emergency cases" of "severe" shock. They have a hopelessly inadequate circulation, their capillaries are widely dilated and permeable, plasma is being lost rapidly to the tissues, their cerebral circulation is ineffective, their vital centres are failing, they have a high hæmoconcentration, and their blood volume has already been reduced by 2,500 cubic centimetres.

These are the three main grades of shock. To these must be added patients with uncontrollable hæmorrhage, and moribund patients.

Five grades are then recognized: (*a*) severe, (*b*) medium, (*c*) mild, (*d*) the shock of moribund patients, (*e*) the shock that accompanies uncontrollable hæmorrhage.

Method of Transfusion in the Five Grades of Shock.

1. In the first group were the patients presenting a clinical picture of severe shock and having a systolic blood pressure of less than 60 millimetres of mercury. Their

blood volume was judged to have been reduced by at least 2,500 cubic centimetres, and 1,000 cubic centimetres of serum were given as rapidly as possible. In this series, with the apparatus available, and the divided attention consequent on rush periods, the average time for the administration of the first 1,000 cubic centimetres to patients suffering from severe shock was just over twenty minutes. When individual attention was possible, the time was ten to fifteen minutes. Five hundred cubic centimetres of serum and 500 cubic centimetres of blood were then given at rapid drip rate, the average time for the administration of this second 1,000 cubic centimetres being sixty minutes. If the response to the first 1,000 cubic centimetres had not been satisfactory, the second 1,000 cubic centimetres were given more rapidly. A satisfactory response to the first 1,000 cubic centimetres was a vast improvement in the clinical condition and a rise in the systolic blood pressure to between 90 and 100 millimetres of mercury. If this had not occurred, serum was given rapidly until the blood pressure rose to this figure; the rate of administration was then reduced to a rapid drip. A final 1,000 cubic centimetres of blood were given as indicated, the administration being started as a slow drip if the response to the second 1,000 cubic centimetres had been satisfactory. A satisfactory response to the second 1,000 cubic centimetres was indicated by the patient's having a good colour, normal respirations and a systolic blood pressure between 110 and 120 millimetres of mercury. If this blood pressure level had not been attained, the administration of the third 1,000 cubic centimetres was started rapidly, to be reduced to a slow drip as soon as the systolic blood pressure reached 110 millimetres of mercury. A patient was considered fully resuscitated when the systolic blood pressure had been 120 millimetres of mercury for one hour. This was regarded as the ideal time for operation, except upon patients suffering severe pain, patients with a tourniquet whose limb it was hoped to save, and patients with uncontrollable hæmorrhage. The last-mentioned men were operated upon at the earliest possible moment after the blood pressure had reached 100 millimetres of mercury. Transfusion was continued during the pre-operative waiting period, to replace the slow loss from wounded tissues. During operation the rate of transfusion was varied with the rate of blood loss. In the immediate post-operative period a few hundred cubic centimetres were given rapidly to restore the blood pressure to 120 millimetres of mercury. The blood pressure was maintained at 120 millimetres of mercury for half an hour after operation before transfusion was stopped.

The first 1,000 to 1,500 cubic centimetres given were serum, because the essential factor in the production of traumatic shock is the reduction in blood volume; serum is just as effective as blood for restoring blood volume and so reestablishing an effective circulation. The patient is suffering from stagnant anoxia; if all the available hæmoglobin is mobilized by increasing the blood volume, there is sufficient oxygen-carrying capacity to reestablish normal function. Serum can be prepared for use more quickly than blood, and with the available apparatus it could be given more rapidly. Clinically, the response to reconstituted "dry" plasma was found to be the same as that to an equal volume of "wet" serum. They were regarded as interchangeable in this series.

2. Patients with the clinical appearance of shock and a systolic blood pressure between 60 and 90 millimetres of mercury were judged to have suffered a reduction of their blood volume by at least 2,000 cubic centimetres. Serum was given rapidly until the blood pressure reached 100 to 110 millimetres of mercury. Serum and blood were given at a slow drip rate during the remainder of the pre-operative period. Blood was given during operation and in the immediate post-operative period, at a rate governed by the blood loss at operation and by the post-operative blood pressure.

Average rates of transfusion in cases of medium shock in this series were as follows: the first 500 cubic centimetres of serum in fifteen minutes, the second 500 cubic centimetres of serum in thirty minutes, and 1,000 cubic centimetres of blood in one to three hours.

Of the 51 patients, 13 had penetrating wounds of the abdomen. They responded in the same manner to the same amounts of fluid given in the same time, as did patients with "medium" shock and other wounds. But, as a much more extensive operation was performed upon the former patients, so that a longer time was taken for operation and blood loss was greater, they received on the average 300 cubic centimetres more serum and 500 cubic centimetres more blood.

3. Patients with the clinical appearance of shock and a systolic blood pressure over 90 millimetres of mercury were judged to have suffered a reduction of 1,500 cubic centimetres in their blood volume. One hundred and fifty-nine such patients were admitted to the resuscitation ward; of these, 60 were given transfusions, while the other 99 responded rapidly to general measures, and transfusion was not necessary. In the estimation of the necessity for giving transfusions to patients suffering from mild shock, repeated blood pressure readings are of the greatest value. If, despite general measures of rest, warmth, relief of pain and drinks, the blood pressure continues to fall, then transfusion is essential. In this series transfusion for such patients was started with serum given at a fast drip rate; this was continued until the blood pressure was normal. A further 500 cubic centimetres of blood were given at slow drip rate. The transfusion was then stopped, except for those patients who had penetrating wounds of the abdomen. Of the 60 patients with mild shock who received transfusions, 24 had penetrating wounds of the abdomen, seven had severe burns, 29 had other wounds. The 29 "other wound" patients received on the average 800 cubic centimetres of serum and 500 cubic centimetres of blood, the first 500 cubic centimetres being given in thirty-five minutes and the second 500 cubic centimetres in sixty-five minutes. The 24 patients with penetrating wounds of the abdomen were maintained with a slow drip transfusion while awaiting operation; the transfusion was continued during operation and in the immediate post-operative period, the rate being varied as necessary. These patients received on an average 600 cubic centimetres of serum and 1,200 cubic centimetres of blood, the first 500 cubic centimetres in thirty-five minutes, the second 500 cubic centimetres in sixty minutes. The seven patients suffering from burns were given serum at slow drip rate. Four such patients received 2,000 cubic centimetres in four hours; these were evacuated for treatment. Three patients treated at the main dressing station were given 1,000 cubic centimetres in one hour and a further 1,000 cubic centimetres twelve hours later.

4. The fourth group consisted of patients suffering from severe or medium shock, whose hæmorrhage it was impossible to arrest. In "severe" cases it was estimated that a reduction of at least 2,500 cubic centimetres in blood volume had occurred, and in "medium" cases the figure was estimated at 2,000 cubic centimetres. Treatment was the same as for other patients with the same degree of shock, except that the blood being lost was immediately replaced. If hæmorrhage was rapid, two veins were used and fluid could be given at the rate of 500 cubic centimetres in two and a half minutes. These patients were operated on as soon as the systolic blood pressure had been raised to 100 millimetres of mercury. Of the 35 patients admitted to the resuscitation ward with severe shock, six had uncontrollable hæmorrhage. They received on an average 1,400 cubic centimetres of serum and 5,400 cubic centimetres of blood. The first 1,000 cubic centimetres were given in twenty minutes and the second 1,000 cubic centimetres in thirty minutes. The largest amount given to any patient was 2,000 cubic centimetres of serum and 8,500 cubic centimetres of blood; in this case hæmorrhage was occurring from both the external iliac and the gluteal arteries. In the "medium" shock group, two cases of uncontrollable hæmorrhage occurred. One of these patients received 1,000 cubic centimetres of serum and 4,500 cubic centimetres of blood, given at the rate of 500 cubic centimetres in ten minutes for the first 3,000 cubic centimetres. This man was not fit for operation for three hours. The second of these two patients received 3,500 cubic centi-

metres of serum and 6,000 cubic centimetres of blood given at the rate of 500 cubic centimetres in five minutes for the first 3,000 cubic centimetres; he was fit for operation in two hours.

5. Moribund patients were those who were admitted to the resuscitation ward unconscious, icy cold and pulseless, with infrequent, irregular, gasping respirations. Seven such patients were admitted, four were given transfusions. Blood and serum were given as rapidly as possible by two veins. In no case was a satisfactory result obtained. One patient gave a partial response and was operated upon after six hours' treatment, when his blood pressure was 80 millimetres of mercury (systolic) and 60 (diastolic). He was given 4,000 cubic centimetres of serum and 4,000 cubic centimetres of blood, the first 1,000 cubic centimetres in five minutes and the second 1,000 cubic centimetres in five minutes. He died eight hours after operation from failure of the respiratory centre. All these patients had suffered irreversible damage to vital structures from prolonged anoxæmia.

Equipment and Supply.

The English overseas pattern transfusion sets were used in all but 16 cases; in these the "Soluvac" apparatus was used.

"Wet" serum (500 cubic centimetres), "dry" plasma (made up to 400 cubic centimetres), 5% glucose solution in 0·3% saline solution (500 cubic centimetres) and stored blood (500 cubic centimetres) were in plentiful supply. The blood was taken at the base and sent forward over 200 miles in refrigerator trucks. It was stored at the main dressing station in a kerosene refrigerator. The age of the blood varied from five days to fourteen days; during the battle it was rarely older than six days. No blood was given if it showed more than faint early hæmolysis.

Method of Recording Cases.

I designed the record card used, and it was produced at the main dressing station by cutting in half army hospital history cards.

On one side these cards record the following information.

Name, serial number, date and time of admission, hours from wounding, blood pressure and pulse on admission, classification—Dangerously Ill (DI) or Seriously Ill (SI).

Classification of shock: mild, medium, severe, moribund, bleeding.

Estimated amount of: serum, blood, glucose saline.

Speed of transfusion: fast, medium, slow (volume and type of fluid to be given at each speed).

Nature of injuries: findings at operation; date of evacuation to casualty clearing station.

At the bottom are three columns of sixteen lines. In the first column time was noted, and against this in the other two columns were recorded volume and type of fluid given, blood pressure, pulse, reactions, operation, drugs or any other observations.

On the reverse side the following information was given:

Name, number, rank, unit, diagnosis.

At the bottom a space for post-operative notes and post-mortem findings. The card was attached to the patient's field medical card upon admission to the resuscitation ward. When the patient left the ward, it was filed by the clerk and was available for post-operative notes.

Procedure after the Patient's Admission to the Resuscitation Ward.

On his admission to the resuscitation ward, each patient was thoroughly examined by the medical officer, dressings were removed and his wounds investigated, and the blood pressure and pulse rate were recorded. The severity of the shock was judged from this examination. The grade of shock was noted on the card by striking out the grades that did not apply.

Morphine and gas-gangrene antiserum were ordered (anti-tetanic serum had been given previously in all cases). The amount and type of fluid required by the patient were then estimated from the grade of shock. For routine transfusion the orderlies were instructed to regard serum and "dry" plasma as interchangeable, use being governed by supply. For this reason "dry" plasma, as distinct from serum, is not noted on the record card under "estimated quantities"; however, the orderly, when recording on the card the fluid given, specified the type. The speed at which the different fluids were to be given was then estimated. Three speeds of transfusion were used: (i) fast (500 cubic centimetres in five to eight minutes), (ii) medium (500 cubic centimetres in twenty to thirty minutes), (iii) slow (500 cubic centimetres in sixty to ninety minutes). The volume of each type of fluid to be given at each speed was noted. The estimated quantities and speeds were varied as necessary if the blood pressure response was not as expected. The needle was introduced into a vein in the cubital fossa—in only eight cases was it necessary to cut down on the vein—and the transfusion was given with the arm lying to the side on the stretcher.

Blood pressure readings were taken by myself and the orderlies as frequently as possible throughout the pre-operative and post-operative periods; no exact interval was found practicable.

Results.[1,2]

Two hundred and fifty-two patients were admitted to the resuscitation ward. They were classified in the following manner: moribund, 7; severe shock, 35; medium shock, 51; mild shock, 159.

Of these 252 patients, 26 died at the main dressing station. Patients were held at the main dressing station for eight to ten days if necessary; no patient was evacuated to the base unless he was fit to travel, and all patients evacuated were expected to live. For analysis the patients have been grouped as follows: (*a*) moribund patients, (*b*) patients with severe shock, (*c*) patients with medium shock, (*d*) patients with mild shock.

Moribund Patients.

A patient was classified as moribund only if all the following criteria were fulfilled: (i) no pulse could be felt; (ii) the patient was unconscious and could not be roused; (iii) the respiratory centre had failed—that is, the respirations were infrequent (four to eight per minute), irregular and gasping.

Records of the seven moribund patients have been analysed to show (i) the time of admission to the resuscitation ward after reception of the wound, (ii) the type of wound, (iii) the volume of fluid given and time taken to give the first and second thousand cubic millimetres, (iv) the results of transfusion and the cause of death.

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[1] Owing to limitations of space, all detailed tabular analyses of results have been omitted from this paper.—Editor.

[2] In the subsequent description of results any reference to hours after receipt of a wound is only approximate, as it was uncommon for the soldier to be able to give more than a rough idea of the time at which he was wounded. When the pulse is shown as "not palpable" on admission to the resuscitation ward, this means that the pulse was not palpable at the wrist. The time taken to give the first and second thousand cubic centimetres of fluid was estimated as the difference in time between the beginning of the first bottle and the beginning of the third bottle (first 1,000 cubic centimetres of fluid), and between the beginning of the third bottle and the beginning of the fifth bottle (second 1,000 cubic centimetres). The times are therefore exact measures of the speed of transfusion. The time taken for the systolic blood pressure to reach 120 millimetres of mercury is the difference in time from the beginning of the transfusion to the time at which the systolic blood pressure is first recorded as having reached 120 millimetres of mercury. The accuracy therefore depends on the number of patients under treatment at any one time, and this varied very considerably. In regard to time of operation, it was the policy at the main dressing station that all patients should be operated upon as early as possible. If it was considered that operation would be performed earlier at the casualty clearing station, then the patient was sent on as soon as he was fully resuscitated. The time to operation was the difference between the time of admission to the resuscitation ward and the time of operation. The hæmoglobin value is stated against the day it was estimated. No readings are shown before the fourth day, as it was found that wide variation occurred in the first few days. The hæmoglobin estimations were made as an attempted check on the volume of blood given. The record is incomplete, as it was possible to follow up only Australian troops after evacuation from the main dressing station. "Traumatic amputation" means a wound producing a complete amputation of the limb.

No satisfactory response to resuscitation was obtained from any moribund patient, despite massive, rapid transfusion into two veins.

Patients with Severe Shock.

Patients classified as suffering from severe shock were those who were not moribund, but had a systolic blood pressure of less than 60 millimetres of mercury. Their case records have been analysed to show: (*a*) the nature of the wound and the time of admission to hospital after its infliction, (*b*) speed of transfusion, (*c*) response to transfusion, (*d*) type and volume of fluid given in each case, (*e*) results of treatment and any complication arising from transfusion. Thirty-five patients with severe shock were treated. Thirteen had a pulse which was not palpable at the wrist when they were admitted. The majority of the patients were admitted in the six to eight hour period after being wounded, but eleven had been wounded between twelve and twenty-four hours previously. One unfortunate prisoner of war was not treated until thirty-six hours after he was wounded.

The nature of the wounds varied widely. They can be roughly classified as follows: (*a*) multiple wounds with at least one major fracture, twelve; (*b*) single wounds with a major fracture or traumatic amputation, twelve; (*c*) penetrating wounds of the abdomen and thoraco-abdominal wounds, nine; (*d*) penetrating wounds of the chest (with pneumothorax) complicated by a major fracture, two.

Average Readings for Speed, Volume and Response to Transfusion.

For average readings to have any value the patients must be divided into two groups: (A) Patients who had no severe bleeding either during resuscitation or at operation. (B) Patients who had severe bleeding either during resuscitation or at operation. The two groups are shown in Table I. Patients in Group A responded more rapidly to smaller quantities of blood and serum given more slowly.

TABLE I.

Observation.	Group A. (29 Cases.)	Group B. (6 Cases.)
Time for first 1,000 cubic centimetres of fluid.	25 minutes.	20 minutes.
Time for second 1,000 cubic centimetres of fluid.	65 minutes.	30 minutes.
Time for blood pressure to reach 120 millimetres of mercury.	1 hour 20 minutes.	2 hours.
Total serum	1,800 cubic centimetres.	1,400 cubic centimetres.
Total blood	1,500 cubic centimetres.	5,400 cubic centimetres.

Results of Treatment.

Five patients died at the main dressing station—Cases XVIII, XIX, XXXII, XXXIII, XXXV.

CASE XVIII.—The patient died on the sixth day. The cause of death was toxæmia from an infected wound. Hind-quarter amputation of the left thigh and left iliac colostomy were performed.

CASE XIX.—The patient died fourteen hours after operation. The cause of death was traumatic shock. This patient needed urgent massive transfusion. He had been wounded for thirty-six hours. He had shell fragment wounds of the right arm and left leg with compound fracture. He was actively uncooperative, and, despite needles being tied into both an arm and a leg vein, transfusion could not be given satisfactorily. It appeared that he wanted to die; he was a young German prisoner of war.

CASE XXXII.—The patient died eight hours after operation. The cause of death was pressure pneumothorax.

CASE XXXIII.—The patient died thirty-six hours after operation. The cause of death was traumatic shock. This patient had a large penetrating shell fragment wound of the left side of the chest with hæmopneumothorax, also a traumatic amputation of the right arm and multiple penetrating wounds of both legs. He responded well to resuscitation and was operated upon two hours after admission to hospital. For the first twenty-four hours following operation his condition was moderately good: respirations numbered 36 and pulse rate was 110; he was slightly cyanosed, but responded rapidly to oxygen; his mentality was clear. In the next twelve hours his blood pressure fell steadily; the respiratory rate rose to 50; cyanosis was not relieved by oxygen; his mentality rapidly became clouded; the patient became extremely restless. Left-sided hæmopneumothorax occurred under no increase of pressure; no more than two and a half pints of fluid were in the left side of the chest. No consolidation of the right lung was noted. No response to any treatment occurred; only a transitory rise of blood pressure followed rapid transfusion. Death was due to failure of the respiratory centre.

CASE XXXV.—The patient died thirty-six hours after operation. The cause of death was traumatic shock. The wound was a perforating shell fragment wound of the buttock to the right groin involving both the femoral and gluteal vessels. No bleeding was present when the patient was first admitted to hospital; he responded rapidly to serum transfusion, and then started to bleed. The blood pressure fell rapidly to 50 millimetres of mercury, systolic, and 30 millimetres, diastolic; bleeding could not be arrested and was rapid. Transfusion was given by two veins. The blood pressure was raised to 100 millimetres of mercury, systolic, and 80 millimetres, diastolic, in three hours. At operation the right common iliac artery was tied, and left iliac colostomy was performed for extensive extraperitoneal hæmatomata involving pelvic walls and pelvic colon. The patient's condition was good during operation and in the immediate post-operative period. The post-operative blood pressure was 120 millimetres of mercury, systolic, and 80 millimetres, diastolic. Subsequent course was exactly similar to that in Case XXXIII. No further bleeding occurred, but gradual falling off of general condition, which was not influenced for more than very short periods by any treatment. Death occurred from failure of the respiratory centre.

Complications.

The only post-operative complication of transfusion was a mild jaundice. This occurred in eight of the 21 cases that it was possible to observe. It appeared usually on the third day as a staining of the conjunctivæ and a faintly positive reaction for bile was obtained in the urine. The jaundice faded slowly; it had usually gone by the eighth day.

Among the 35 patients admitted with severe shock there were three deaths from shock, all post-operative; two other patients died, while the remainder were all evacuated to base in good condition.

Patients Suffering from Medium Shock.

Patients were classified as suffering from medium shock when they were admitted to hospital with a systolic blood pressure between 60 and 90 millimetres of mercury; 51 patients were treated. For analysis they have been divided into two groups: (*a*) those patients with an intra abdominal injury; (*b*) those patients with other wounds.

The patients were suffering from the following wounds:

1. An intraabdominal injury, fifteen.

2. Other wounds, thirty-six: (*a*) multiple wounds with a major fracture, fourteen; (*b*) multiple wounds without fracture, six; (*c*) single wounds with a major fracture or traumatic amputation, ten; (*d*) multiple wounds including a penetrating wound of the chest, six.

Group I: Penetrating Wounds of the Abdomen.

Patients admitted with medium shock suffering from a penetrating wound of the abdomen numbered fifteen.

To obtain significant average readings two cases (XIII and XIV) must be excluded, as the patients had hæmorrhage which could not be arrested in the pre-operative period:

Time for first 500 cubic centimetres of fluid was fifteen minutes.
Time for second 500 cubic centimetres of fluid was thirty minutes.
Time for systolic blood pressure to reach 120 millimetres was one hour.
Total serum given was 1,300 cubic centimetres.
Total blood given was 1,500 cubic centimetres.

Group II: Other Wounds.

The entire 36 cases of medium shock with "other" wounds have been analysed to give the following average readings:

Time for first 500 cubic centimetres of fluid was fifteen minutes.
Time for second 500 cubic centimetres of fluid was thirty minutes.
Time for systolic blood pressure to reach 120 millimetres of mercury was one hour.
Total serum given was 1,000 cubic centimetres.
Total blood given was 1,000 cubic centimetres.

By comparying the average readings of Group I and Group II it will be seen that the patients in both groups were given transfusions at the same speed and that the response to the transfusion was the same. Patients with intraabdominal lesions received on the average 300 cubic centimetres more serum and 500 cubic centimetres more blood than those with other wounds, but with the same degree of shock.

Time from Receipt of Wound.—The majority of patients were admitted to hospital in the six to eight hour period after being wounded; ten patients were in the eight to ten hour period, eight in the 18 to 24 hour period, and two were admitted thirty hours after being wounded.

Deaths.

Of the 51 patients admitted to hospital with medium shock, six died. All six were patients with abdominal wounds.

Analysis of Deaths.—All the patients were in Group I.

1. Case II: Death occurred on the third day from peritonitis.
2. Case III: Death occurred on the third day as a result of toxæmia from an infected wound of the buttock and pelvic cellulitis.
3. Case IV: Death occurred on the second day from peritonitis.
4. Case XIII: Death occurred on the twelfth day as a result of toxæmia from infected wounds of both legs.
5. Case XIV: Death occurred on the third day from peritonitis.
6. Case XV: Death occurred twenty-four hours after operation from general peritonitis.

There were no deaths from shock during either the pre-operative or post-operative period.

Complications of Transfusion.

Ten patients became jaundiced of the thirty who could be observed in the post-operative period. In nine cases the jaundice was very mild; one was severe (Group I, Case VIII). The patient had a thoraco-abdominal wound, with a penetrating wound of the liver producing considerable liver damage. His jaundice was probably due to the liver wound. No other complication of transfusion occurred in the post-operative period.

Patients Suffering from Mild Shock.

Patients were classified as suffering from mild shock when the systolic blood pressure was over 90 millimetres of mercury and the patient had the clinical appearance of shock.

One hundred and fifty-nine patients with mild shock were admitted to the resuscitation ward; 60 of these received transfusion. For analysis they have been divided into two groups:

Group A.—Patients in this group numbered 60 and received transfusions.

1. Patients with penetrating wounds of the abdomen 24
2. Patients with multiple wounds and a major fracture 4
3. Patients with multiple wounds without fracture 12
4. Patients with a single wound and a major fracture 10
5. Patients with a penetrating wound of the chest and other injury 3
6. Patients with burns 7

Group B.—Patients in this group numbered 99 and did not receive transfusions.

1. Patients with wounds of the neck and head 7
2. Patients with penetrating wounds of the chest 21
3. Patients with wounds of the arm and fracture 20
4. Patients with wounds of the leg and fracture 13
5. Patients with multiple wounds without fracture 32
6. Patients with non-penetrating wounds of the abdominal wall 6

Group A has been divided into three groups for analysis of transfusion records: (i) patients with penetrating wounds of the abdomen, (ii) patients with burns, (iii) patients with other injuries.

Patients with Penetrating Wounds of the Abdomen.

Twenty patients have been listed in this group as suffering from penetrating wounds of the abdomen. The average readings have been made out from the 24 patients with mild shock (abdominal injuries).

Time for first 500 cubic centimetres of fluid was 35 minutes.
Time for second 500 cubic centimetres of fluid was 60 minutes.
Time for systolic blood pressure to reach 120 millimetres of mercury was less than half an hour.
Total serum given was 600 cubic centimetres.
Total blood given was 1,200 cubic centimetres.

Patients with Burns.

Seven patients with burns were admitted to the resuscitation ward; they were all admitted within four hours of being burned, and all had extensive second degree burns from petrol fires. Four were sent to base for treatment. A serum transfusion was given in the ambulance, 2,000 cubic centimetres being given in four hours. All these patients arrived at the base in good condition. Three were treated at the main dressing station. They were given 1,000 cubic centimetres of serum during operation and 1,000 cubic centimetres of serum twelve hours after operation. One patient was given a further 500 cubic centimetres of serum twenty-four hours after operation, as his hæmoglobin value was 110%. All patients were evacuated to the casualty clearing station on the fourth day in good condition.

In this group twenty cases have been listed. The average readings have been taken from the 29 patients with mild shock ("other" wounds).

Time for first 500 cubic centimetres of fluid was 35 minutes.
Time for second 500 cubic centimetres of fluid was 65 minutes.
Time for systolic blood pressure to reach 120 millimetres of mercury was half an hour.
Total serum given was 800 cubic centimetres.
Total blood given was 500 cubic centimetres.

Patients with intraabdominal wounds received 500 cubic centimetres more fluid than those with other wounds, despite the fact that the average blood pressure on admission was higher in patients with intraabdominal wounds.

In chest wounds with hæmopneumothorax, if they were not complicated by other major wounds no fluid was given intravenously. If another major wound was present, fluids were given, but with extreme caution, as early in the series two patients of this type developed acute pulmonary œdema after operation.

Time from Receipt of Wound to Admission.

Of 24 patients with intraabdominal wounds, 16 were admitted to hospital in less than eight hours from being wounded; eight were admitted 10 to 14 hours after being wounded.

Seven patients with burns were all admitted under four hours from time of injury.

Of 29 patients with "other" wounds, 15 were admitted under eight hours after being wounded; six were admitted in the eight to twelve hour period; six were admitted in the fourteen to sixteen hour period; two were admitted over twenty-four hours after being wounded.

Results.

Eight deaths occurred among the 159 patients admitted with mild shock. A short account of these eight deaths is as follows.

CASE I.—The wound was a large, penetrating shell fragment wound of the left side of the chest, between the third and fifth ribs in the mid-axillary line. Torn stomach was protruding through the wound. There was also a penetrating wound in the right iliac fossa. The patient was admitted to hospital four hours after being wounded with a systolic blood pressure of 120 and a diastolic pressure of 80 millimetres of mercury; the pulse rate was 120 in the minute and respirations numbered 30. He was not judged to be operable. No resuscitation was given and he died eight hours after admission. The cause of death was traumatic shock.

CASE II.—The wound was a perforating gunshot wound of the abdomen (Case XX, Group I). He was admitted six hours after being wounded. His systolic blood pressure was 125 and his diastolic pressure 75 millimetres of mercury; the pulse rate was 120 in the minute. The patient responded rapidly to transfusion. At laparotomy the abdomen was found to be disorganized; all the viscera were involved in the wound, and the patient was judged to be inoperable. The systolic blood pressure after operation was 110 and the diastolic pressure 70 millimetres of mercury. The patient died three hours after operation and the cause of death was traumatic shock.

CASE III.—The wound was a perforating gunshot wound of the face involving the base of the skull. The systolic blood pressure on the patient's admission to hospital was 95 and the diastolic pressure 40 millimetres of mercury; the pulse rate was 50 in the minute. The patient died two hours after admission and the cause of death was cerebral injury.

CASE IV.—The wounds were penetrating shell fragment wounds of the abdomen, arm and back (Case VI, Group I). The patient was admitted to hospital four hours after injury. His systolic blood pressure was 120 and his diastolic pressure 80 millimetres of mercury; the pulse rate was 92 in the minute. At operation a large hæmatoma was seen involving the abdominal aorta. Operation was satisfactory. The systolic blood pressure after operation was 130 and the diastolic pressure 70 millimetres of mercury. The patient died suddenly two hours after operation, and the cause of death was rupture of the abdominal aorta.

CASE V.—The wound was a large, penetrating shell fragment wound of the left side of the chest posteriorly, involving the abdomen and thorax (Case I, Group I). At operation perforated stomach presented at the wound. The diaphragm and chest wall were sutured; a large tear in the stomach and many penetrations of the small bowel were sutured. The systolic blood presure after operation was 100 and the diastolic pressure 80 millimetres of mercury. The patient's condition was moderately good for three days, and then he developed toxic mental symptoms. He was evacuated to the base on the sixth day and died on the eighth day. The cause of death was toxæmia from an infected left hæmopneumothorax.

CASE VI.—The wound was a penetrating shell fragment wound of the right side of the chest with hæmopneumothorax, and there was also a penetrating shell fragment wound of the right leg. On the patient's admission to hospital his systolic blood pressure was 95 and his diastolic pressure 70 millimetres of mercury; his pulse rate was 136 and the respiratory rate 30 in the minute. The patient's condition improved rapidly with rest, morphine and a transfusion of 500 cubic centimetres of serum and the same quantity of blood. The leg was dressed. The patient's condition was moderately good for the first twenty-four hours, but then deteriorated rapidly. There was no response to any form of treatment. There was no pressure in the right side of the chest. No signs of consolidation were present in the left lung. The patient died thirty-six hours after admission, and no autopsy was performed. The cause of death was traumatic shock.

CASE VII.—The wound was a large penetrating shell fragment wound of the right side of the chest posteriorly. The patient was admitted to hospital one and a half hours after being wounded. The systolic pressure was 95 and the diastolic pressure 70 millimetres of mercury; the pulse rate was 140 and the respiratory rate 35 in the minute. There was continuous bleeding from the wound, but the patient responded well to resuscitation. Before operation the systolic blood pressure was 120 and the diastolic pressure 80 millimetres of mercury. Operation was performed one and a half hours after admission, anæsthesia being produced by 1·7 grammes of "Pentothal Sodium". The lung and the chest wall were sutured. Oxygen was given continuously during the operation. Artificial respiration had to be instituted for one period of five minutes. The patient died one hour after operation, and death was ascribed to the anæsthetic.

CASE VIII.—The wound was a penetrating shell fragment wound of the abdomen. The patient was admitted to hospital four hours after being wounded. The systolic blood pressure was 95 and the diastolic pressure 75 millimetres of mercury; his pulse rate was 140. Response to resuscitation was rapid, the systolic blood pressure before operation being 130 and the diastolic pressure 80 millimetres of mercury. At operation many holes in the small bowel were sutured. Many holes were present in both ascending and descending colons. The bowel was resected and iliac colostomy was performed. After operation the systolic blood pressure was 90 and the diastolic pressure 70 millimetres of mercury. The patient's condition was good for three days, but he died on the sixth day, the cause of death being bronchopneumonia.

The cause of death of these eight patients may be summarized as follows. Two patients were not operable and died within six hours of admission. One patient had a cerebral injury and died within two hours of admission. One patient had a ruptured abdominal aorta and died two hours after operation. One patient had toxæmia from an infected hæmopneumothorax and died on the eighth day. One patient had bronchopneumonia and died on the sixth day. One patient had traumatic shock and died thirty-six hours after admission. One patient died one hour after operation as a result of anæsthesia.

Complication of Transfusion.

Mild jaundice occurred in ten patients; no other complication was noticed.

CONCLUSION.

The value of any method of treatment can only be judged by results. In this series 252 patients with shock were treated; 26 died. Eighteen died within forty-eight hours of admission, the remaining eight from the third to the eighth day. All patients were held at the main dressing station until considered fit to travel to the base; all patients evacuated were expected to live. The eight men who died from the third to the eighth day all died of toxæmia from infection of their wounds.

Analysis of Deaths Occurring within Forty-Eight Hours of Admission.

An analysis of the eighteen dying within forty-eight hours of admission shows that they were from the following shock groups: moribund, 7; severe shock, 4; medium shock, 1; mild shock, 6.

Moribund Patients.

All patients admitted moribund died; all but one died within one hour of admission. Five died from traumatic shock. One died from hæmorrhage from the splenic pedicle and one died from extensive cerebral injury. Three of these patients were not given transfusion.

Severe Shock.

Four deaths occurred within forty-eight hours in the severe shock group. One patient died eight hours after operation from pressure pneumothorax. Two died from a condition clinically indistinguishable from traumatic shock thirty-six hours after operation. One died fourteen hours after operation from traumatic shock. Treatment was unsatisfactory in this case, because of intentional and very active resistance.

Medium Shock.

One death in the medium shock group occurred from general peritonitis twenty-four hours after operation.

Mild Shock.

Six deaths occurred in the mild shock group within forty-eight hours of admission. A *résumé* of the histories of these cases has been given in a previous section.

The analysis of deaths shows that patients unconscious and moribund from shock will not respond to this method

of treatment. All other patients can be recovered to an operable condition; they can be sustained through long operations and their circulation can be returned to normal in the immediate post-operative period. Severely wounded patients uncommonly develop shock (three in 252) in the late post-operative period; if this condition develops without hæmorrhage, the patient will not respond to this method of treatment.

Classification of Shock in Relation to Treatment.

The investigation was undertaken to prove the practical value of a method of classification of the degrees of shock, to show the efficiency of a method of treatment, and to establish: (i) The standard volume of blood and serum required for the treatment of each grade of shock. (ii) The optimum (standard) rate of transfusion for each grade of shock. (iii) The frequency, character and cause of reactions during transfusion. (iv) The frequency, character and severity of complications of transfusion. (v) The prognosis in traumatic shock. (vi) The cause of death of all patients who die at the main dressing station.

A classification of grade of shock is essential if any standards are to be found. The method of transfusion employed in this series depended upon accurate classification of every patient. All patients admitted were readily classified and conformed to the standards of their grade. The results of the series were good and show the efficiency of the method of treatment employed.

Volume of Liquid Required.

The volume of blood and plasma loss necessary to produce the different grades of shock had been established as: severe shock, 2,500 cubic centimetres; medium shock, 2,000 cubic centimetres; mild shock, 1,500 cubic centimetres.

These estimated volumes were to the time of admission. Therefore patients whose bleeding could not be arrested, and those with severe shock who continued to lose plasma to the tissues for some time after admission, were expected to need a larger volume. Three thousand cubic centimetres was the expected total volume of transfusion for patients with severe shock. Patients with penetrating wounds of the abdomen who had to be maintained through long and severe operations were also expected to need more blood. The "expected" volumes of transfusion were only used as a guide, the actual volume given each patient being governed by his response. The results are shown in Table II.

TABLE II.

Type of Shock.	Expected Volume. (Cubic Centimetres.)	Actual Average Volume for Series. (Cubic Centimetres.)
Severe ..	3,000	1,800 serum, 1,500 blood = 3,300
Medium ..	2,000	1,000 serum, 1,000 blood = 2,000
Mild ..	1,500	800 serum, 500 blood = 1,300

The standard volumes of blood and serum required for each grade of shock were found to be: severe shock, 3,000 to 3,500 cubic centimetres; medium shock, 2,000 cubic centimetres; mild shock, 1,000 to 1,500 cubic centimetres.

Rate of Transfusion.

From previous experience I am sure that transfusion is usually given far too slowly. No harm can result from transfusion given at the rate of 500 cubic centimetres in two and a half minutes to a patient with a greatly reduced venous return. Rapid transfusion results in rapid resuscitation and allows early operation which is of supreme importance in forward war surgery, particularly in patients with abdominal wounds. I think that the results of this series, particularly in regard to "bleeding" patients and those with intraabdominal lesions, emphasize the value of rapid transfusion.

The standard rates of transfusion for each grade of shock were found to be as follows.

Severe Shock.—A total of 1,000 to 1,500 cubic centimetres is given at the rate of 500 cubic centimetres in five to ten minutes. When the systolic blood pressure has reached 90 to 100 millimetres of mercury the rate is reduced to 500 cubic centimetres in thirty minutes. Transfusion is continued at this speed until the systolic blood pressure is 120 millimetres of mercury. It is then continued at a slow drip (500 cubic centimetres in sixty minutes) until operation; during operation the rate is varied with the blood loss. In the immediate post-operative period a few hundred cubic centimetres are given rapidly to restore the systolic blood pressure to 120 millimetres of mercury.

Medium Shock.—A total of 500 cubic centimetres is given in ten to fifteen minutes. When the systolic blood pressure reaches 100 to 110 millimetres of mercury, the rate is reduced to 500 cubic centimetres in thirty minutes. When the systolic blood pressure is 120 millimetres of mercury, transfusion is continued at a slow drip until operation, when the rate is governed by the blood loss. A few hundred cubic centimetres are given rapidly in the immediate post-operative period to restore the systolic blood pressure to 120 millimetres of mercury.

Mild Shock.—A total of 500 cubic centimetres is given in thirty minutes until the systolic blood pressure is 120 millimetres of mercury. Then a further 500 to 1,000 cubic centimetres are given at slow drip rate (500 cubic centimetres in sixty minutes).

Bleeding Patients.—Blood is given as rapidly as possible, and two veins are used, the rate being 1,000 cubic centimetres in five minutes until the systolic blood pressure has reached 100 millimetres of mercury, when operation is performed. As soon as the bleeding has been stopped the patient is treated as though he was suffering from severe shock.

Moribund Patients.—Use two veins. Give blood and serum as rapidly as possible until the systolic blood pressure rises to 100 millimetres of mercury. The patient is then treated as though he was suffering from severe shock.

The Character, Frequency and Cause of Reactions during Transfusion.

Febrile reactions during transfusion were common, occurring in about 50% of the patients who received transfusions. The patient complained of feeling cold and started to shiver, shivering was severe and involved the whole body; the temperature rose to between 102° F. and 104° F. The patient complained of a slight headache and of feeling giddy and frequently of a tight feeling in the chest. No patient complained of back pains. Vomiting occurred during the reaction in about one-third of the cases. The pulse rate increased and the blood pressure rose rapidly. The systolic blood pressure frequently rose to 150 millimetres of mercury, when the reaction occurred at the end of the transfusion period. In the majority of cases the bottle of blood or serum was changed immediately the shiver started, the reaction lasted as a rule twenty minutes, and it subsided gradually. In the late stages of the battle, when supply was very short and considerable experience had been gained, the rate of transfusion was slowed as soon as the reaction occurred, but the bottle was changed only if the reaction was severe or the patient was suffering from severe shock. It was found that if transfusion was continued even at a slow drip, the reaction subsided very slowly; vomiting was more common, but no serious harm resulted.

Twenty patients had more than one reaction during their transfusion. Five patients had febrile reactions during post-operative transfusion before recovery from anæsthesia; the reaction of these men was associated with a mild cyanosis, which was rapidly relieved by oxygen. Two developed an urticarial rash in the flanks and over the abdominal wall during a prolonged reaction.

The reaction was upsetting to the patient and destroyed the steady measured recovery from shock that was the ideal. The blood pressure fell rapidly to its former level as soon as the reaction subsided. The pulse rate remained rapid for a considerable period. The temperature fell slowly and sweating occurred. Response to transfusion was normal as soon as the reaction subsided.

Reactions were all of the same type and varied only in severity.

A febrile reaction during transfusion can have any of the following causes: (i) incompatible blood, (ii) high anti-isoagglutinin titre of the donor's serum, (iii) infected transfusion fluids, (iv) improperly cleaned apparatus.

The following transfusion fluids were used:

(i) Blood. All blood used was O4. It was taken at the base directly into citrate solution in the 500 cubic centimetre bottle. It was transported 200 miles in refrigerator trucks. All blood on arrival at the main dressing station was thoroughly stirred up. It settled in twenty-four hours with a good line of demarcation, but all bottles showed some slight hæmolysis; any bottle of blood showing more than slight hæmolysis, or not having a good white cell blanket, was discarded. Many bottles were sent to the base for testing; no infected bottle was found.

(ii) "Wet" serum. Most of the "wet" serum came from England; some was produced at the base. The serum frequently contained some precipitated material. No bottle showing uniform turbidity was used. Many turbid bottles were sent to base for examination; one infected bottle was found.

(iii) "Dry" plasma. This was produced in England and was supplied together with a bottle of water (400 cubic centimetres) for reconstitution. The dry plasma was reconstituted just before use.

(iv) Glucose 5% in 0·3% saline solution. This was produced at the base and sent forward in rubber corked bottles. It was given by "Soluvac" apparatus cleaned at the main dressing station.

Bottles and giving sets were washed immediately after use, but the giving sets were not dismantled. No serious cleaning was undertaken in forward areas, repair and cleaning of all apparatus being done at the base.

Febrile reactions occurred just as frequently with serum as with blood, but were uncommon when reconstituted dry plasma was used; very few patients had febrile reactions with glucose saline solution.

The reaction started in almost every case after 200 cubic centimetres of the bottle had been given. About 50% of patients had reactions. The majority of patients received five bottles of fluid, so about one in ten bottles gave a reaction.

The blood used was all O4 group. No gross incompatibility occurred. This was judged at the time of the reaction because it occurred after 200 cubic centimetres of the bottle had been given and because there was no back pain; it was proved later, as no serious after-effects were observed. A high anti-A and anti-B isoagglutinin titre of the donor serum may have caused some of the reactions to blood. The wet serum was pooled and was of low titre. The blood was taken from the donor directly into the 500 cubic centimetre bottle, and it is possible that some of the reactions in Group A2 recipients may have been due to a high anti-A isoagglutinin titre in the donor's serum. That this was not a significant cause of reactions is shown by the fact that Group O4 recipients had the same proportion of reactions as did those of Group A2.

Bottles of blood and serum were carefully selected before use, any faintly suspected of being infected being discarded, and the worst being sent for bacteriological examination. Of thirty bottles examined, one bottle of serum was infected. Infection of the fluids for intravenous use cannot have been responsible for the many reactions that occurred.

The febrile reaction was typically a reaction to a foreign protein. Incomplete cleansing of bottles and giving sets must be blamed. Very few reactions occurred with the use of reconstituted "dry" plasma for which special new giving sets were supplied. The fault may have been in either the giving sets or the bottle, but the bottle seems the more likely, as a giving set was used for two bottles of blood or serum, and frequently the reaction occurred while the second bottle was being given.

The Frequency, Character and Severity of Complications of Transfusion.

Acute pulmonary œdema occurred in two patients immediately after operation. They were both suffering from penetrating wounds of the chest and other major injuries. Both had a complete hæmopneumothorax; both had prolonged ether anæsthesia; both responded satisfactorily to atropine and continuous oxygen therapy. It is probable that this condition was initiated by rapid transfusion, and I think that penetrating wounds of the chest with pneumothorax are a definite contraindication to rapid transfusion. No other contraindication was found in these young healthy men.

A mild jaundice developed on the second to third day in about 20% of the patients who received transfusion. It was most pronounced on the fourth or fifth day, and showed as a staining of the conjunctivæ and produced a reaction for bile in the urine. Usually it had faded by the eighth day. It occurred most frequently in those who had a reaction during transfusion, but also in those who had no reaction. Some patients were still jaundiced when they reached base hospitals. These were the men evacuated early (second and third day). A mild albuminuria with a few granular casts persisting for thirty-six hours after transfusion occurred in nearly all patients who had a reaction during transfusion. No other abnormality of kidney function was found. Surgeons in base hospitals said that wounds appeared to heal less rapidly in those who had received massive transfusion. No local infection or phlebitis occurred at the site of transfusion.

The Prognosis in Traumatic Shock.

The ultimate prognosis in the case of wounded men depends on the nature and the site of the injury; but the immediate prognosis depends on the degree of shock. Recovery from shock means recovery to a condition in which the wound can be adequately dealt with by operation. Once this condition has been reached it can be maintained during operation and in the immediate post-operative period by adequate transfusion. The only patients who cannot be recovered from shock are those who have suffered irreparable damage to vital structures from prolonged anoxæmia. Clinically these are the moribund patients of this series—patients admitted unconscious, with slow irregular gasping respirations, a pulse not palpable at the wrist, and just palpable with difficulty in the neck. These men will not respond to any treatment; they die from failure of the respiratory centre. A patient who is admitted conscious should never be classed as moribund, no matter what his history, appearance or blood pressure, because failure of the higher centres from prolonged anoxæmia must precede failure of the respiratory and vasomotor centres. For this reason the level of consciousness is the most significant guide to the immediate prognosis.

An impalpable pulse at the wrist is common in severe shock (13 of the 35 of this series); the initial blood pressure reading is therefore of no great value for prognosis.

Once treatment has started serial blood pressure readings are the most reliable guide to response to treatment and so to prognosis. If the classification adopted for this series is used, only moribund patients should die from shock in the pre-operative, operative or immediate post-operative periods.

Patients with medium and mild shock are always recoverable from their shock, and their prognosis depends upon the nature and the site of the injury. Patients in whom hæmorrhage cannot be arrested have a good immediate prognosis if transfusion is given rapidly in adequate quantities. Operation must be performed at the earliest possible moment after the systolic blood pressure has been forced up to 100 millimetres of mercury. Once hæmorrhage has been arrested they respond in the usual manner.

Shock in the immediate post-operative period readily responds to transfusion if the pre-operative preparation has been adequate. Shock developing twenty-four to thirty-six hours after operation has a very bad prognosis, if

there is no blood loss to account for it. Prognosis beyond the thirty-six hour post-operative period depends upon infection.

The Cause of Death of all Patients Dying at the Main Dressing Station.

The fatal cases for each grade of shock have been discussed. Post-mortem examinations were done on the majority of patients, but a few who died during rush periods could not be so examined. The post-mortem findings are my own and not those of an expert pathologist, but the cause of death was usually obvious. Deaths from cerebral injury not complicated by any other wound or by hæmorrhage are excluded from this series, as the subjects were not admitted to the resuscitation ward.

SUMMARY.

1. A method of classification was evolved for the grade of severity of traumatic shock occurring in wounded soldiers. Standard volumes and speeds of transfusion were estimated for each grade of shock.

2. An investigation was undertaken to show that the classification was of practical value and to establish the standards.

3. A record card was designed and complete records were made of 150 patients who received transfusions.

4. All patients admitted to hospital were readily classified.

5. From an analysis of the record cards the standard volumes and speeds of transfusion for each grade of shock were established, the reactions and complications of transfusion were studied, and the prognosis in traumatic shock was determined.

6. An attempt was made to establish the cause of death of all patients dying at the main dressing station.

ACKNOWLEDGEMENTS.

I wish to acknowledge the help and encouragement received from Lieutenant-Colonel B. S. Hanson, D.S.O., O.B.E., and the helpful criticism of Lieutenant-Colonel C. G. McDonald. I make grateful acknowledgement to the orderlies, Lance-Corporal Wardman and Privates Quinlan, Phillips, Tregenza, Bennell and Robinson, and to the clerk, Private Gold, for their hard and accurate work.

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THE TREATMENT OF CARCINOMA OF THE DORSUM OF THE HAND.

By P. D. BRADDON,
Sydney.

THE problem of the treatment of carcinoma of the dorsum of the hand, viewed simultaneously from both surgical and radio-therapeutic aspects, resolves itself into three categories: (i) the treatment of relatively early carcinomata, (ii) that of advanced carcinomata, (iii) that of advanced carcinomata unsuitable for radio-therapy.

Relatively Early Carcinomata.

Relatively early carcinomata are almost invariably of the squamous-celled variety; in some thousands of cases only six instances of basal celled carcinoma have been encountered. The term "early" must be accepted, not in terms of time, but relative to the state of advancement of the growth, as these lesions often grow very slowly at first, and may remain for several years in the "early" category. This type of lesion, up to a little over 2·0 centimetres in diameter, is best treated surgically, for while the lesion is of such dimensions that it can be readily excised under local anæsthesia and the skin approximated, this treatment offers a certain, rapid and economical means of cure with a minimum of inconvenience and expense to the patient. Such lesions can be treated just as efficiently by the methods to be described for the advanced growths, and private patients frequently insist on this.

Advanced Carcinomata.

Advanced carcinomata are growths over 2·5 centimetres in diameter and upwards. It is especially the purpose of this article to discuss the treatment of this group, which is based on 200 consecutive and unselected cases, in all of which treatment has been carried out during the last eight years by the writer.

FIGURE I.

Natural size photograph. Exceedingly foul squamous celled carcinoma of the dorsum of the right hand, measuring approximately 7·0 by 6·0 centimetres. Treated by radon mould at 1·5 centimetres' distance, the dosage being 6,000 *r* over sixteen days.

Advanced Carcinomata Unsuitable for Radiotherapy, which must be Subjected to Surgery.

The third group comprises only three patients, and the reasons why they were unsuitable for treatment as in the second group are as follows.

In the first case the entire hand, including the bones, and excluding only the thumb, was involved in a large fungating growth, the result of over two years' treatment by herbalists. This patient is the only one of all those

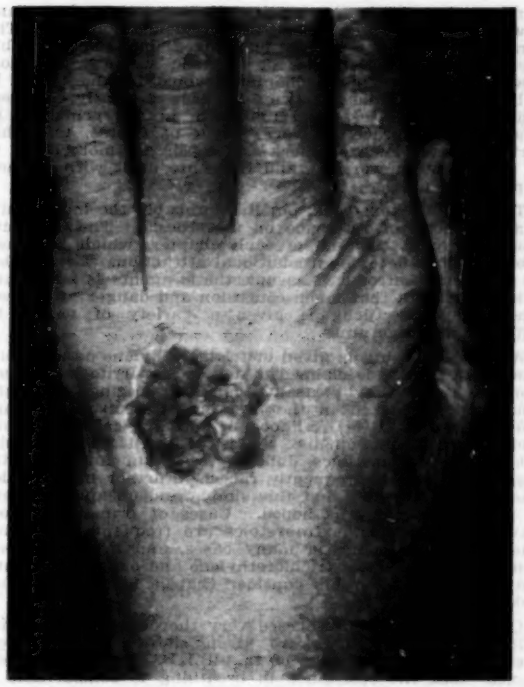

FIGURE II.
Nine weeks after treatment. Complete healing has followed skin grafting to central area (about 3·0 centimetres in diameter) ten days previously. Same case as shown in Figure I.

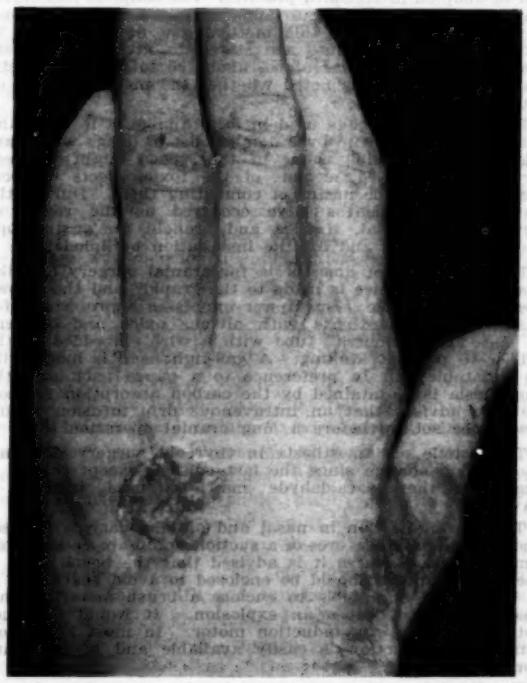

FIGURE III.
Final result, three months after treatment. Patient back at work. Function of hand excellent; slight limitation of movement of fingers, owing to long-standing chronic arthritis. Same case as shown in Figure I.

seen in eight years who developed secondary deposits in the axillary glands, and the only patient who died of the disease, in spite of amputation of the hand and excision of the axillary glands.

In the second of the three cases the growth had penetrated the interosseous spaces and fungated in the palm. Partial amputation was performed, and the axillary glands was excised, but though they were enlarged, no malignancy could be detected in them microscopically.

In the third case surgery was employed, because of radio-necrosis and recurrence, the result of treatment by X rays elsewhere. Partial amputation was performed, and the result was disappointing, owing to sloughing of tissues and poor healing.

Discussion.

An efficient follow-up system is in operation at the radium clinic of the Royal Prince Alfred Hospital, where the majority of these patients were treated over the last eight years. Most of the patients are seen regularly for over two years after treatment, and many for over three years. Human nature is such that few patients, apparently cured, will continue reporting regularly for much over

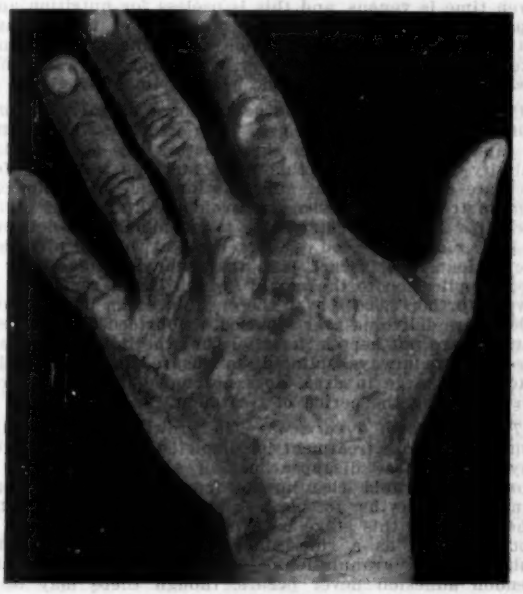

FIGURE IV.
End result of treatment by radon mould of a second case of ulcerated carcinoma of hand, 3·5 centimetres in diameter, centred over the base of the second metacarpal bone. Function 100%.

three years. It is quite evident to one dealing with large numbers of these cases that, for some reason difficult to explain, metastases are extremely late and rare from growths in this situation.

Treatment of Patients in the Second Group.

To revert to the main theme of this article—namely, the treatment of 200 patients in the second group: all these lesions, however large, have been treated by radon moulds, with consistently excellent results. In the treatment of this lesion, radium or radon needles or seeds should never be implanted. The dose delivered is always 6,000γ *r* over a minimum period of ten days and a maximum period of sixteen days. The majority of lesions are treated over a period of fourteen days. Every patient has had an excellent result with excellent function, regardless of the extent of the lesion. There is not a single failure to record, not a single case of radio-necrosis, recurrence or development

of late secondary deposits in axilla or elsewhere. Many of these lesions have been large and exceedingly foul.

Three factors account for the consistently good results obtained: (i) accurate dosage, (ii) accurate distribution, (iii) time.

Accurate Dosage.—These lesions invariably receive 6,000γ *r*, delivered, as calculated, by a radon mould, usually at a distance of 1·0 centimetre, occasionally at 1·5 centimetres. Filtration is that of the radon needles, capillary or seeds employed—namely, 0·5 or 0·8 millimetre of platinum equivalent.

Accurate Distribution.—The radio-active sources must be so distributed that the calculated dose is homogeneously delivered to the entire area. This is a problem in itself, and it is just as vital to success as the calculation of the amount of radon required to deliver the dose over the given area.

Time.—Squamous-celled carcinoma of the skin elsewhere are given a routine dose of 6,000 *r*, but usually over a period of seven days. However, the skin of the dorsum of the hand has certain local peculiarities, which render it specially liable to radio-necrosis. It is an area of poor arterial blood supply; much of the blood present at any given time is venous, and this is useless for nutrition and repair. Also, the type of skin and age of the average patient suffering from this lesion determine a parchment-like condition, more or less atrophic, and the noticeable absence of subcutaneous tissue peculiar to this region.

Comment.—In excising large numbers of early lesions from this area, one cannot help being struck by the paucity of capillary bleeding. In these factors lies the peculiar liability to necrosis of this area, and the necessity for accurate dosage, accurate distribution and the prolonged time of treatment necessary to avoid the disaster of radio-necrosis. Routine treatment by radon mould is a delivery of 3,000 *r* over a period of seven days, at the end of which the patient reports back, and the radon is replaced by a fresh application to the mould (which is not removed) to give a further 3,000 *r* over the ensuing seven days. Thus 6,000 *r* are delivered over a period of fourteen days. These patients are not kept in hospital; but the hand, wrist and forearm are always splinted, to ensure that the mould, often very large in area, does not move in the slightest degree during the period of treatment.

The Results of Treatment.—The growth is already disappearing before treatment is completed, and the next ten days usually see disappearance of all clinical signs of growth and rapid cleaning-up, from the frequent foul, fungating growths to clean and healthy granulations. These may at this stage be skin grafted; but grafting is not necessary as a rule, since if one exercises a little patience, the granulations invariably heal completely. Tendon adhesion never occurs, though there may be a little scarring on the surface. In the most extreme cases healing is complete in some eight weeks following treatment, though some months may elapse before all signs of reaction have completely disappeared. One of the pleasing features of this treatment is the consistently excellent function of these hands; scarring and tendon adhesions are conspicuous by their absence, and function is almost invariably 100%.

Reviews.

PROGRESS IN ANÆSTHESIA AND ANALGESIA.

THE fourth edition of "Recent Advances in Anæsthesia and Analgesia" maintains the high standard of its predecessors.[1] There is little difference in this edition in the number of pages or the number of illustrations, but many new plates have been inserted and old ones omitted. The arrangement of chapters is unchanged, but some, notably the section on anæsthesia for thoracic surgery, is almost rewritten. There is no chapter devoted to anæsthesia in military and air-raid practice. Dr. Hewer rightly considers that there is no essential difference in the principles of anæsthesia in peace or war. It is, of course, true that certain factors such as shock and sepsis are more likely to be prominent in wartime, and these are dealt with in their appropriate places.

This is not a text-book, but it is probably the most useful available book of reference on anæsthesia. The extensive bibliography at the end of each chapter, which has been brought up to date, is an additional attraction. The number of new drugs introduced as anæsthetic agents is small, and it is pointed out that much confusion and danger are caused when the same drug is given a variety of names by different manufacturers.

A careful account is given of trichlorethylene as a general anæsthetic, and it is claimed that it is non-irritating, induction is rapid and pleasant, capillary oozing is slight, analgesia is marked in the first stage, electrocardiograph studies suggest little likelihood of primary cardiac failure, and it is non-inflammable. It is admitted that muscular relaxation is sometimes difficult to obtain and that the respiratory rate is frequently raised. Further investigation has shown, however, that this simple and cheap anæsthetic is not as safe as was hoped. Cases of primary syncope have been reported, extrasystoles are frequent, tachypnœa has been troublesome in many cases, and in certain percentages a mixture of trichlorethylene and oxygen is inflammable. Some observers consider that it is no safer than chloroform.

Oxygen therapy is discussed very thoroughly and a large number of illustrations are given showing the different methods. The drawbacks of the "B.L.B." inhaler are mentioned—that the resistance to breathing is considerable at low oxygen flows and the carbon dioxide concentration may exceed 2%. Furthermore the variation in oxygen concentration of the inspired air is as high as 18%, fluctuating with the depth of respiration. To overcome this the injector unit is recommended and it is suggested that this arrangement will be adopted in standard practice. The simplest technique, which requires no elaborate apparatus, consists of the use of nasal catheters; by this method gas flows of four to sixteen litres per minute are stated to give oxygen percentages in the alveolar air of about 30 to 60 respectively, and little difference is noted whether the mouth is open or shut.

The chapter on drugs used in local analgesia is long, and much of it is taken up by a detailed list of drugs which are seldom used: possibly some of this space might be used for a more detailed account of the toxic effects of local anæsthetics and the means of combating them. During the last few years deaths have occurred as the result of spraying the throat, trachea and bronchi for gastroscopy and bronchoscopy and for the installation of lipiodol.

The difficulties of anæsthesia for cranial surgery are discussed and reference is made to the "rapid" and the "slow" operative technique. Dr. Hewer expresses a preference for naso-tracheal anæsthesia with nitrous oxide and oxygen; he uses an "armoured" tube with a wire embedded in the rubber to prevent kinking. A gas-tight seal is made with an inflatable cuff in preference to a gauze pack and the anæsthesia is maintained by the carbon absorption method. He also advises that an intravenous drip infusion should always be set up before a long cranial operation.

The article on anæsthesia in thyreoid surgery does not show much change since the last edition, except that it is suggested that paraldehyde may be used instead of "Avertin".

The use of suction in nasal and oral surgery is stressed and the desirable features of a suction pump are enumerated. Among these features it is advised that the brush gear of the electric motor should be enclosed to avoid sparking. It is practically impossible to enclose a brush motor so that sparking cannot cause an explosion. It would be much better to employ an induction motor. In most large hospitals steam suction is easily available and is quiet and constant.

This book provides a concise collection of the most important advances in anæsthesia during recent years. It is well produced and easy to read and contains a fund of information for the benefit of anæsthetist, surgeon and general practitioner.

[1] "Recent Advances in Anæsthesia and Analgesia (Including Oxygen Therapy)", by C. Langton Hewer, M.B., B.S., D.A. (R.C.P. and S., Eng.); Fourth Edition; 1943. London: J. and A. Churchill, Limited. 8" x 5¼", pp. 352, with 135 illustrations. Price: 18s.

The Medical Journal of Australia

SATURDAY, APRIL 22, 1944.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

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A REPORT ON HOUSING.

In November last housing in Australia as a post-war problem was discussed in these pages. Reference was made on that occasion to a report by The Institution of Engineers, Australia, and to a somewhat similar document put out by the New South Wales Chapter of the Royal Australian Institute of Architects. Regret was expressed that the practising members of the medical profession had not initiated an inquiry into housing through their own official organization; and it was suggested that engineering, architecture and medicine should combine in the preparation of a statement for presentation to the Commonwealth Housing Commission. In addition to all this, mention was made of a report that was to be prepared by Sir Raphael Cilento and Dr. E. Sydney Morris for the meeting of the National Health and Medical Research Council last December. In our short discussion of the proceedings of this meeting in our issue of April 1, 1944, the receipt of the report was mentioned and further reference to it was promised.

The report is divided into four parts. The first is introductory and historical; the second deals with housing problems in Australia; the third mentions specific attempts that have been made at housing improvement; the fourth contains the conclusion. The historical section is of the greatest interest and should be widely read. Indeed the whole report could with benefit be reprinted and sold in pamphlet form. It is almost exactly a hundred years since housing became a public health problem. A little more than a hundred years ago it was reported that in Manchester about 12% of the working class families, or 15,000 persons, lived in 3,500 cellar dwellings. Conditions of life, with their filth and squalor, were almost beyond description, and it is small wonder that epidemics of enteric fever, dysentery, cholera and typhus fever took enormous toll of the lives of the people. The only streets recognized by the authorities were those "dedicated to the public". Unpaved and unsewered streets were not so dedicated; they retained their filth, never being visited by the public scavenger. The use of cellars or underground rooms was prohibited in Manchester in 1853. Further progress was made by the passage of the English *Public Health Act of* 1868 and by other acts passed between that year and 1878. An attempt was made to raise the standard of houses and powers were given to the authorities in certain circumstances to clear away whole areas of slums. But difficulties there were because of property rights and the building schemes of the private entrepreneur, the "spec builder" of today. On the whole progress was slow and it was not until 1925 that back-to-back houses were actually made illegal in England. Before the war of 1914-1918 almost all the houses in England were built by private enterprise. There were plenty of houses for those who could afford to pay a reasonable rental, but there were never enough low-rented houses to meet the needs of the poorer sections of the community. Conditions became worse after the war and certain necessary changes were effected by the *Housing Act of* 1919. Under this act local authorities were made responsible for meeting the housing needs of their areas, subsidies were to be made available to local authorities to enable good houses to be let at reasonable rentals, and some assistance was to be given in the laying down of suitable standards for working men's homes. Since 1919 housing has been one of the main political considerations. The responsibilities of local authorities have been varied, but the standard for the workers' home "has maintained its new features". According to the Tudor Walters report such houses should be built not more than twelve to the acre in well-planned estates and each standing in its own ground. A large living room, with a sunny aspect if possible, was regarded as essential, and every house was to be provided with a bath in a separate room, a water closet approached under cover, a larder of reasonable size and a coal store. After setting out the historical approach to the subject, an outline of which has been given here, the authors of the report come to what is the root of the matter. With the statement that experience has shown everywhere that the problem of housing is most complex extrinsically and intrinsically, they refer to the report of the Industries Group of "Political and Economic Planning" (P.E.P.) entitled "Housing England", issued in December, 1934. Here it was shown that the extrinsic complexity had to do with three factors. The first was that of the housing problem proper which is basically a question of shortage, the second was the rent problem, and the third the rent-paying capacity of the people. "Failure to recognize or to apply these principles and conflicts between public and private enterprise have materially handicapped action in England since the war of 1914-18 and provided valuable object lessons to other governments."

Turning to housing problems in Australia, the authors of the report remark that the English problem is not the Australian problem. They add that the standard of living in this country is infinitely better than that of many other lands, and that there are few, if any, where so great a proportion of workers own their own homes, as is the case in some of the Australian States. Probably what they mean is that the difference is one of degree, for we cannot see that from the health or the economic points of view there is much fundamental difference. They admit that there are in Australia to differing degrees the three problems of general housing, rural housing and slum clearance; and to these they add tropical housing and a problem that is inherent in all—town planning. There

are in Australian cities certain areas where sub-standard houses are found in large numbers—this is stated by the authors of the report, and areas of this kind have been described from time to time by contributors to this journal. The fact that the standard of living in this country is better than that found in others, makes the existence in our midst of areas of sub-standard houses all the more reprehensible. It may be, as our authors suggest, that there is still time to obviate the mistakes of previous generations. On the other hand it is probably true that many of the mistakes of long ago are being perpetuated. In the search for a remedy the authors of the report deal with specific attempts that have been made at housing improvement. We cannot follow them in this, but reproduce in full some thirty principles that were laid down in 1938 by the Committee on the Hygiene of Housing of the American Public Health Association. These principles, which are set out in the report, were adopted by the National Health and Medical Research Council for recommendation to the Australian governments and authorities concerned. The thirty principles are as follow:

A. Fundamental Physiological Needs.

1. Maintenance of a thermal environment which will avoid undue heat loss from the human body.
2. Maintenance of a thermal environment which will permit adequate heat loss from the human body.
3. Provision of an atmosphere of reasonable chemical purity.
4. Provision of adequate daylight illumination and avoidance of undue sunlight glare.
5. Provision for admission of direct sunlight.
6. Provision of adequate artificial illumination and avoidance of glare.
7. Protection against excessive noise.
8. Provision of adequate space for exercise and for the play of children.

B. Fundamental Psychological Needs.

9. Provision of adequate privacy for the individual.
10. Provision of opportunities for normal family life.
11. Provision of opportunities for normal community life.
12. Provision of facilities which make possible the performance of the tasks of the household without undue physical and mental fatigue.
13. Provision of facilities for maintenance of cleanliness of the dwelling and of the person.
14. Provision of possibilities for reasonable æsthetic satisfaction in the home and its surroundings.
15. Concordance with prevailing social standards of the local community.

C. Protection Against Contagion.

16. Provision of a water supply of safe sanitary quality, available to the dwelling.
17. Protection of the water supply system against pollution within the dwelling.
18. Provision of toilet facilities of such a character as to minimize the danger of transmitting disease.
19. Protection against sewage contamination of the interior surfaces of the dwelling.
20. Avoidance of insanitary conditions in the vicinity of the dwelling.
21. Exclusion of vermin which may play a part in the transmission of disease.
22. Provision of facilities for keeping milk and food undecomposed.
23. Provision of sufficient space in sleeping rooms to minimize the danger of contact infection.

D. Protection Against Accidents.

24. Erection of the dwelling with such materials and methods of construction as to minimize danger of accidents due to collapse of any part of the structure.
25. Control of conditions likely to cause fires or to promote their spread.
26. Provision of adequate facilities for escape in case of fire.
27. Protection against danger of electrical shock and burns.
28. Protection against gas poisonings.
29. Protection against falls and other mechanical injuries in the home.
30. Protection of the neighbourhood against the hazards of automobile traffic.

The National Health and Medical Research Council, in adopting these principles, insisted that the most important portion of any house from the point of view of national survival was the "economic centre", the kitchen, laundry and other places where the housewife controlled the vital centre of the home. The Council also appointed a sub-committee consisting of Sir Raphael Cilento, Dr. C. L. Park and Dr. F. McCallum, "with power to consult any person having reliable information, to investigate medical aspects of housing and to report to the next meeting".

By now most people will be prepared to agree that doctors should interest themselves in the medical aspects of housing. It is, however, not easy to say where the medical aspects of the subject begin and end. The limits cannot be said to begin and end with the type of house, its size, its position and its equipment. The principles of the American Public Health Association go beyond this. Medicine must concern itself with all that goes to make a healthful and happy environment for mankind. It cannot logically pass by the three factors of extrinsic complexity described in the "P.E.P." report on the ground that they encroach on the economic or political fields. To do so would be a hypocritical evasion, a denial of trust. Doctors may be, indeed most of them probably are not, skilled in economics and in the political aspects of the housing question. They can see, however, that healthful housing cannot be achieved if the cost is not right. Houses cost money. A well-planned home of the approved type already mentioned costs more than a hovel and some one has to pay. To say that the question of who shall pay is not the concern of the doctor is extreme foolishness. It is the concern of every citizen and of the doctor more than most because of his special mission as a promoter of health. Though the question cannot be fully discussed on this occasion, two aspects may be briefly mentioned. The first is that many houses which are in the lower, sub-standard, grades can probably be made more or less acceptable if money is spent on them. Owners who look only for profit will not spend money on improvements unless they are compelled to do so. The earnest law-maker can, if he will, devise legislation that shall achieve the desired end. One interesting suggestion, recently emanating from a legal source, is that rates on sub-standard houses should be so high that it would pay owners to improve the property. If the property was not improved, the rates should go into a fund from which improvements could be made on the property resumed. If the property was improved and could be classed as having attained a declared standard, the rates would be the normal prevailing rate. Other ideas will probably present themselves to ingenious readers. The second aspect has to do with the erection of new houses, whether they are built in new areas or in place of demolished slums. The cost must be as low as possible. To this end doctors and engineers might confer on what equipment was necessary for a health-giving home; engineers and architects should arrange what structural apparatus was suitable for general inclusion, and whatever was decided on could be produced in large quantities and thus be cheaper. The

estimates for building homes should be carefully made and the building should be done by those who could see that the estimates were not exceeded. Those who have any experience of building operations in recent years will consent that every one concerned must agree to work hard, not to excess, but to the best of his capacity. If post-war building is to be looked on as a happy hunting ground for slackers and job-controllers, nothing but failure can be predicted. Even when the buildings are erected the rent must be within the earning capacity of the proposed occupiers. This carries the discussion into yet another sphere, but the temptation to enter it must be resisted. We should like to see the committee appointed by the National Health and Medical Research Council go beyond the strictly narrow interpretation of the "medical aspect" of housing and deal with the other aspects that have been mentioned.

Current Comment.

MUMPS.

MUMPS is regarded as being probably the least infectious of the common infectious diseases. It is a droplet infection and the causative organism is held to be a virus. There are certain curious features about its incidence and its manifestations and these are not known as widely as they should be; references to the disease in text-books on general medicine are by no means exhaustive. In these circumstances it appears that attention should be drawn to a recent paper by R. E. Smith, who is medical officer to Rugby School, England.[1] This paper is really complementary to an earlier paper by the same author that appeared in *Guy's Hospital Reports* in 1937 (Volume LXXXVII, page 447). First of all in regard to nomenclature, mumps is sometimes regarded as synonymous with epidemic parotitis (Smith uses the title mumps). Mumps, as Smith points out, may affect the parotids, the submaxillary and sublingual glands, and the complications may be secondary to inflammation of any of these groups. C. E. van Rooyen and A. J. Rhodes in their book "Virus Diseases of Man" state that it is "somewhat inaccurate" to regard mumps and epidemic parotitis as synonymous. Epidemic parotitis is the commonest manifestation of the virus of mumps, but it is not the only one. They point out that the "other manifestations" of mumps are orchitis, meningo-encephalitis, pancreatitis and ovaritis, that these usually follow the development of parotitis and may then be regarded as its complications. In other cases, they state, these manifestations may either precede parotitis or occur independently of it. In the latter circumstances mumps orchitis or meningo-encephalitis would appear as a primary manifestation after exposure to infection. These views of van Rooyen and Rhoades are reflected in Smith's discussion on the portal of entry. In his 1937 paper he stated that the mouth is the portal of entry, mumps being a droplet infection. This view is commonly held. It receives a certain amount of support from the work of Johnson and Goodpasture, who induced parotitis in monkeys by the injection into their parotid ducts of saliva taken from patients suffering from mumps in the early stage of the disease. After repeated passage through monkeys over many months, this same virus was injected into the mouths of human volunteers, being sprayed in the direction of the parotid ducts; in certain of the susceptible persons typical mumps developed. Smith in his latest paper refers to an hypothesis advanced by Philibert in 1932, that the virus may enter through the conjunctiva and multiply in the central nervous system. Philibert, Smith tells us, supported his hypothesis by numerous records from the literature to show the variable time relationships in the occurrence of the inflammations of the salivary glands and the meninges. Philibert realized that meningeal lesions usually follow salivary gland involvement, but reported cases in which the parotitis followed a meningitis or did not occur, although persons in contact with the meningitis later developed typical mumps within the usual incubation period. Smith refers to two observations which appear to him to support Philibert's hypothesis. The first is the observation of de Massary and his colleagues that a lymphocytosis is always present in the cerebro-spinal fluid, whether there is clinical involvement of the meninges or not. The second is that the disease appears to be infectious for at the most one day before the swelling appears, whereas "if the virus was incubating in the parotid gland itself it would probably be infectious throughout the whole course of the incubation period". From the clinical point it may be held that it is immaterial how the virus gains entry into the body, but such a view would not necessarily be correct. The position regarding our knowledge of the portal entry in mumps is much the same as it is in connexion with some other virus diseases. Accurate knowledge will some day be obtained, and when this happens prophylaxis may possibly be a simpler matter.

Smith gives some interesting information on the attack rate. At Rugby School it has been found, in a period of fifty years, that outbreaks may vary from one in which a single boy is attacked to one in which 189 boys were affected (138 during term and 51 in the holidays)—an attack rate of 42% of the whole boarder population of 448 boys and 63% of the 300 who were said not to have had a previous attack. These figures are higher than those of others. In a special report on epidemics in schools issued by the Medical Research Council of Great Britain in 1938 and drawn up by its Schools Epidemics Committee, some details of outbreaks of mumps in boys' and girls' schools are given. Among a total of 33 outbreaks there were two among boys in which over 100 were affected. In the first, 128 cases represented an attack rate of 16·1% of the whole population and 25·8% of the susceptibles. In the second outbreak, 116 cases represented an attack rate of 21·9% of the whole population and 36·1% of the susceptibles. It was found that the disease in these outbreaks continued to produce fresh cases until the end of term. This lingering character of the disease was characteristic of all outbreaks of any material size.

Of the complications the most usual is orchitis. It rarely occurs before puberty. Smith states that after puberty it affects 22% of patients. "Atrophy in varying degrees follows, but sterility is exceptional and feminism a medical curiosity." Spermatogenesis can be reestablished some months after apparent complete aspermatogenesis. Among Smith's 138 boys there were 13 with orchitis or involvement of some part of the genital tract. One of those with orchitis did not have a definite parotid swelling. Of the 13 patients, seven developed their complications while they were still in bed. This observation is in accord with those of many clinicians and is held by van Rooyen and Rhoades to be an argument against the view that minor traumata to which the testicle is naturally exposed have something to do with the causation of orchitis. These authors state that it is established that undue sexual activity is a predisposing cause to orchitis. Smith thinks that the risk of boys developing complications should be no deterrent to allowing them to get up reasonably soon after the mumps has subsided. He produces evidence also to show that boys are not infectious three to four days after the swelling has disappeared. Fourteen boys were discharged approximately on the eleventh day after the appearance of the swelling and three days after its subsidence; they came into close contact with members of their own families and none of the latter became affected by mumps. On this type of finding Smith's opinion is justified that quarantine of contacts is wasteful.

In future work that is done on this subject it would be interesting to discover why apparently susceptible persons exposed to infection do not always contract the disease. If this was made clear other obscure points might find a simple explanation.

[1] *Guy's Hospital Reports*, Volume XCII, Number 1, 1943.

Abstracts from Medical Literature.

THERAPEUTICS.

Furmethide.

S. H. BEASER, J. H. LIPTON AND M. D. ALTSCHULE (*The American Journal of the Medical Sciences*, October, 1943) discuss the treatment with furfuryltrimethyl-ammonium iodide of urinary retention due to bladder atony. Thirty-one patients were studied, suffering from urinary retention due to operations distant from or on the bladder or from nervous disease. In retention following thyreoidectomy, herniorrhaphy and other operations, 75% of the patients voided urine normally after one or two doses of furmethide; sweating, salivation and lachrymation were unpleasant side effects. Following moderate trauma to the bladder after childbirth, after hysterectomy and other local trauma 78% responded favourably. Four or five milligrammes of furmethide were given subcutaneously once or twice a day. In other cases 15 to 20 milligrammes of furmethide were given orally four times a day, and administration was continued if necessary for some weeks (up to eight weeks); good results were obtained. In multiple sclerosis, transverse myelitis and other nervous organic lesions, subcutaneous or oral administration of furmethide relieved retention to a degree in seven out of eight cases. Flushing, tachycardia, sweating, salivation and transient disturbance of visual accommodation were sometimes observed. Vesical tonus was increased. Furmethide had less action on bronchi and the cardio-vascular system than "Mecholyl" and less action on the gastro-intestinal tract than "Doryl" or prostigmine, but its action on the urinary tract was much stronger. Furmethide was effective in some cases in which "Doryl" and "Mecholyl" were unsuccessful. All these drugs act best in retention of unknown ætiology during infections or in the post-partum or post-operative state. The drugs should be used as soon as the condition is suspected and before the bladder becomes distended if possible; it acts better at this stage. Three milligrammes of furmethide should cause evacuation of the bladder in five or ten minutes. If not, the dose should be increased by increments of one milligramme until five milligrammes are reached. If evacuation is not complete, catheterization should be instituted. As a rule the subcutaneous dose should not be repeated for eight hours, but ten milligrammes may be given orally two to three hours after the subcutaneous dose. This oral dose may be increased if necessary, and the *régime* of subcutaneous followed by oral dosage continued indefinitely. Later oral dosage also may be used.

Dicoumarin.

L. R. WASSERMAN AND D. STATES (*The American Journal of the Medical Sciences*, October, 1943) have described clinical investigations on 3, 3-methylenebis (4-hydroxycoumarin). This substance has been used as an anticoagulant instead of heparin. Dicoumarin is inexpensive and can be given orally. Seventy-one patients were treated for pulmonary embolism and infarction, thrombophlebitis, peripheral arterial disease, and venous embolism or thrombosis. Two hundred to five hundred milligrammes were given daily when necessary. The coagulation time and the prothrombin index were studied before and after treatment. The drug was not given when the prothrombin index was less than 50%. Treatment with 400 to 2,000 milligrammes produced a prolongation of coagulation time and reduction in the prothrombin index, but the two effects were not always concurrent. In obstructive jaundice the effects were variable. Generally the results were very variable in different individuals, so that a workable dosage scheme could not be formulated. The action of the drug was sometimes delayed, sometimes mild and at other times profound.

Hydrarthrosis.

L. PELNER (*The American Journal of the Medical Sciences*, October, 1943) has described the rapid removal of excess joint fluid by acid salts. Traumatic hydrarthrosis is a frequent result of injury to the knee joint with or without serious damage. X-ray examination may be necessary to exclude fracture within the knee joint, but in most cases massive effusions are associated with ligamentous sprains without demonstrable gross tearing or cartilaginous injury. The treatment consists of the use of a diet without sodium chloride, the giving of unrestricted fluid, the daily administration of 90 grains of ammonium chloride, bed rest and application of an ice cap to the knee. The diet allowed has a low sodium content and contains acid-forming foods, that is, meat, fish or fowl, in fair amount. The result of this *régime* was to reduce the fluid in the joint in four cases out of seven. Similar results had been obtained in rheumatoid arthritis with joint effusion.

Subacute Bacterial Endocarditis.

L. LOWE, P. ROSENBLATT, A. J. GREENE AND M. RUSSELL (*The Journal of the American Medical Association*, January 15, 1944) have described combined penicillin and heparin therapy in subacute bacterial endocarditis. Penicillin alone was unfavourably reported on in the treatment of *Streptococcus viridans* infections of this type. From 40 to 200 thousand Florey units of penicillin were given, and the total dosage ranged from 867,920 to 7,890,340 Florey units. Heparin was given in doses of 300 milligrammes subcutaneously, usually along with an intravenous drip of penicillin. There were no significant toxic effects. The immediate results suggest uniformally successful sterilization of the blood and relief from clinical symptoms. Preliminary use of sulphonamide in a few cases may have helped the treatment.

Sublingual Drug Therapy.

R. P. WALTON (*The Journal of the American Medical Association*, January 15, 1944) has discussed sublingual administration of drugs. Recently it has been suggested that sublingual administration of commonly used drugs is effective. The author rebuts this claim and produces evidence to show that while glyceryl trinitrate and erythrityl tetranitrate are rapidly absorbed from beneath the tongue, morphine and its derivatives are not. High solubility in fats is one of the properties of drugs which are thus absorbed. Testosterone compounds are readily absorbed sublingually and are more potent in this way than when swallowed. Œstradiol is also as effective under the tongue as it is by injection. Anhydrohydroxy progesterone is similarly effective. Desoxycorticosterone acetate in Addison's disease is effective in tablets, or in propylene glycol solutions, especially after 20% alcohol is added. Apomorphine, nicotine and cocaine are readily absorbed under the tongue. Ergonovine, strychnine and picrotoxin are absorbed, but epinephrine and ephedrine are poorly absorbed, as are strophanthin and digitoxin.

Aminophylline.

G. A. MERRILL (*The Journal of the American Medical Association*, December 25, 1943) has reported three sudden deaths following intravenous administration of aminophylline. In a case of coronary occlusion four hours after the onset 0·125 gramme of aminophylline was slowly injected intravenously. The patient's face registered pain and his breathing and heart sounds stopped within a few seconds. In a case of asthma in which the blood pressure was recorded at 200 millimetres of mercury systolic and 90 millimetres diastolic, and which did not respond to epinephrine or oxygen, 0·25 gramme of aminophylline was injected intravenously; within thirty seconds the patient's respiration ceased and no heart sounds could be heard. Intracardiac injection of epinephrine produced no effect. The third case was one of acute cardiac decompensation associated with *cor bovinum* in which death occurred immediately after intravenous injection of aminophylline. Two other cases in which sudden death followed immediately on intravenous injection of aminophylline for asthma are also mentioned. The cause of death in these cases was not discovered. It was said to resemble death after intravenous injection of epinephrine, which is said to be due to ventricular fibrillation. The author suggests that safer drugs should be used in these conditions if possible.

NEUROLOGY AND PSYCHIATRY.

Diffuse Leucoencephalopathy without Sclerosis.

HERMAN JOSEPHY AND BEN. W. LICHTENSTEIN (*Archives of Neurology and Psychiatry*, November, 1943) point out that Schilder's disease and diffuse sclerosis are terms often used to designate a diffuse degeneration of the white substance of the brain. The condition usually occurs in children, and gives rise to muscular hypertonicity, spastic paralysis, epileptic fits, choreo-athetoid movements and mental degeneration. The outcome is fatal. The cases here presented are those of two siblings, whose parents were healthy second cousins. Hydrocephalic-like enlargement of the head was noted at an early age. Both children commenced to walk later than usual. Their gait was unstable. The older child had his first seizure at thirteen years of age; the younger one at four. Spasticity and choreo-athetoid movements developed. Speech deteriorated until it became completely lost. An

autopsy was performed on the older child, and the results—both macroscopic and microscopic—are presented in detail. Degeneration was restricted to the subcortical white substance and the *centrum semiovale*. There was complete absence of any reaction to degeneration of myelin sheaths. There were neither gitter cells nor evidence of proliferation of the macroglia. The authors believe this disease to be an heredodegeneration, transmitted by a recessive gene. Whether the various clinical morphological types of degenerative diffuse sclerosis represent different morbid entities or are merely variations of a single basic process, remains to them an open question.

Acute Arrest of Cerebral Circulation in Man.

RALPH ROSEN, HERMAN KABAT AND JOHN P. ANDERSON (*Archives of Neurology and Psychiatry*, November, 1943) claim to describe the first controlled investigation on the effects of acute arrest of the circulation of the human brain; and they are impressed by the remarkable sensitivity of cerebral function to acute anoxia. They have designed an apparatus in the form of an inflatable cervical pressure cuff which is held down to the lower third of the neck. The pressure in the cuff rises to 600 millimetres of mercury in one-eighth of a second. This sudden inflation of the cuff shuts off the blood supply to the brain before the next heart beat, so that engorgement of the cerebral vessels is prevented. The deflation of the cuff can be accomplished either by the patient or the physician in a fraction of a second. The first effect of cerebral vascular occlusion is, after about five seconds, fixation of the eyeballs. This is followed by blurring of the vision, constriction of the visual fields, loss of consciousness and anoxic convulsions. The authors found this response to occur with great rapidity and to be constant from subject to subject. Recovery of consciousness is quickly obtained and patients are able to walk unaided from the room within two minutes of the termination of the experiment. Investigation was made upon normal and abnormal subjects. It is regarded as free from risk. The cerebral circulation was, in some schizophrenic patients, arrested for as long as 100 seconds. No change was noted in their mental state. Loss of consciousness follows invariably about one second after the fixation of the eyeballs. Variations in sensitivity to cerebral circulatory arrest in healthy young individuals is ascribed to differences in cerebral metabolism.

Homosexuality: A Biological Anomaly.

EDWIN G. WILLIAMS (*The Journal of Nervous and Mental Disease*, January, 1944) recognizes two types of homosexual—the man who may, in certain circumstances, indulge in homosexual practices and the man who possesses the physical form of a male and the temperament of a female. He calls these latter feminine male homosexuals, and finds that they differ from other types in that the usual decrease in serum cholinesterase following administration of prostigmine does not occur. The estimation of serum cholinesterase was made by the manometric method of Rinkel and Pijvan. An estimation was made prior to the subcutaneous injection of one milligramme of prostigmine methylsulphate; forty-five minutes later a second estimation of cholinesterase was made. A number of homosexual case histories of the subjects tested in this manner are given. Of the twelve feminine male homosexual subjects, none showed an appreciable decrease in cholinesterase activity; and the author concludes that there is a definite biological difference between the two homosexual types. The masculine male homosexuals whom he studied and who showed the normal cholinesterase reaction he proposes to call facultative homosexuals.

Studies in Subconvulsive Electric Shock Therapy.

B. H. GOTTESFIELD, S. M. LESSE AND H. HERSKOVITZ (*The Journal of Nervous and Mental Disease*, January, 1944), in their investigation of convulsive and subconvulsive shock therapy, have experimented with different leads. They find that biparietal leads require the lowest voltage acting over the shortest time. They further found that subconvulsive electroshock therapy in a series of twenty-four cases proved of doubtful value. Moreover, it was noted that fear reactions developed in fifteen of the patients treated by subconvulsive doses. Even in those cases associated with hypertension, advanced age, cardio-renal disease and general arteriosclerosis where it might be assumed that subconvulsive doses would be of value, these authors obtained dubious results—a mere temporary improvement in ward reactions.

Shock Therapy in the Involutional and Manic-Depressive Psychoses.

J. A. BIANCHI AND C. J. CHIABELLO (*The Psychiatric Quarterly*, January, 1944) have reported on their treatment, by electric shock or metrazol, of 87 patients suffering from involutional psychoses and 134 manic-depressive patients. They brought about from fifteen to twenty convulsions. They list the usually accepted contra-indications. Among their complications were two compression fractures of vertebræ, four fractures of the humerus and two lung abscesses. The response to treatment was better among the manic-depressive patients. Of the involutional psychotics, the melancholic types showed a better response than the paranoid types. The depressed and mixed melancholics yield to treatment in greater numbers than the manic types. The best results obtained in the involutional group were among those whose illness was of less than two years' duration. Five of the patients discharged from hospital have relapsed and returned.

The Effects of Benzedrine Sulphate on the Behaviour of Psychopathic and Neurotic Juvenile Delinquents.

BELIEVING that the administration of benzedrine sulphate to individuals causes a greater desire to work, relief of fatigue, elevation of mood, and greater intellectual efficiency, S. R. Korey (*The Psychiatric Quarterly*, January, 1944) made use of it in his treatment of juvenile delinquents. The drug was administered over a period of six weeks, the dosage beginning with five milligrammes and working up to thirty milligrammes per day. A control group of delinquents was given a corresponding number of tablets of sodium bicarbonate. None knew what drugs were being given. In the fortnight which followed the taking of the drug, a check-up was made which showed (*a*) increased work and efficiency, (*b*) accelerated school performance, (*c*) manifest sociability, (*d*) decreased number of misconducts, (*e*) a mood more temperate and even, (*f*) increased responsiveness to interviews. The undesirable reactions produced by overdose were insomnia in four cases, confusion and nervousness in two, and abdominal cramps and loss of appetite in one. There were no withdrawal symptoms. There was no correlation between the response to benzedrine and the patient's intelligence quotient. The underlying personalities of the boys remained unchanged. No insight was acquired and no attempt to understand their own problems was noted. The author feels that benzedrine administration may become a useful adjuvant in the rehabilitation of juvenile delinquents.

Cerebral Arterio-Venous Oxygen Difference.

HAROLD E. HIMWICH AND JOSEPH F. FRAZEKAS (*Archives of Neurology and Psychiatry*, November, 1943) present an investigation of the cerebral arterio-venous oxygen difference in regard to age and mental deficiency. The method adopted of collecting venous blood was that of Myerson, Halloran and Hirsch. The investigation of oxygen differences for undifferentiated mental defectives revealed a significant and progressive increase during growth. The figures were the same for the corresponding age groups, whether the intelligence quotients of the subjects were from 8 to 49 or from 50 to 88. Since there was no evidence to indicate any abnormal change of blood flow in these subjects, the authors concluded that the cerebral metabolic rate was not changed from the normal and that the mental deficiency was not caused by an impaired cerebral metabolic exchange.

PATHOLOGY.

Primary Endometriosis of the Cervix Uteri.

A. F. LASH AND H. RAPPAPORT (*Surgery, Gynecology and Obstetrics*, December, 1943) report on a case of primary endometriosis of the cervix. Only five other cases of this condition were found recorded in the literature. Clinically, it is in the majority of instances characterized by vaginal bleeding with or without dysmenorrhœa and by the presence of a dark red or brownish red growth on the vaginal portion of the cervix, either on the anterior cervical lip or to the right or left of the external os. In four of the six cases malignant disease was suspected and could be ruled out only by histological examination. The condition is most probably due to transplantation of endometrial or decidual tissue fragments to the vaginal portion of the cervix. Its rarity can be explained by the resistance of intact stratified squamous cell epithelium to grafting and by the presence of some degree of infection in cervical lacerations and erosions.

Public Health.

THE BRITISH GOVERNMENT'S "WHITE PAPER" ON A NATIONAL HEALTH SERVICE.

We are indebted to Dr. J. G. Hunter, General Secretary of the British Medical Association in Australia, for the following summary of the proposals by the Government of the United Kingdom for a national health service as contained in the "White Paper".[1]

It is proposed that the new responsibility for providing the comprehensive service shall be put upon an organization in which both central and local authority take part, and which both centrally and locally is answerable to the public in the ordinary democratic manner. Central responsibility will lie with the Minister, local responsibility will lie with the major local government authorities (the county and county borough councils) operating for some purposes severally over their existing areas and for other purposes jointly over larger areas formed by combination. Both at the centre and locally, special new consultative bodies are proposed, for ensuring professional guidance and the enlistment of the expert view. At the centre, in addition, a new and mainly professional body is to be created, to perform important executive functions in regard to general medical practice in the new service.

The new joint authorities, that is, the counties and county boroughs in combination, will be responsible (over suitable areas determined by the Minister after consulting the local interest) for assessing the needs of those areas in all branches of the new service and for planning generally how those needs should best be met. They will do this in consultation with the local professional bodies referred to, and they will submit their proposed arrangements to the Minister for final settlement in each case.

Then, when each area plan is settled, the joint authority will have the duty of securing all the hospital and consultant services covered by it, by their own provision and by arrangements with the voluntary hospitals in the area, and they will for this purpose be responsible in future for the existing local authority hospitals of all kinds. The individual county and county borough councils making up the joint authority will usually be responsible for local clinic and other services within the general framework of the plan, but there will be special provision for the child welfare services—to ensure a close relation between them and child education. General medical practice in the new scheme will be specially organized, largely as a national and centralized service, but with proper links with the local organization to relate it to the hospitals and to other branches of the service as a whole. There will be certain variations of these proposals for Scotland, to suit the differing circumstances there.

The new service will be free to all apart from possible charges where certain appliances are provided. (The payment of disability benefits during sickness—and related questions as to the adjustment of benefit during periods of free maintenance in hospital—are matters which belong to the Government's proposals on social insurance, to be published in a later "Paper".) The costs of the new health service will be borne partly from central funds, partly from local rates and partly from the contributions of the public under any scheme of social insurance which may be brought into operation.

1. Objects in View.

(1) To ensure that everybody in the country—irrespective of means, age, sex, or occupation—shall have equal opportunity to benefit from the best and most up-to-date medical and allied services available.

(2) To provide, therefore, for all who want it, a comprehensive service covering every branch of medical and allied activity, from the care of minor ailments to major medicine and surgery; to include the care of mental as well as physical health, and all specialist services, for example, for tuberculosis, cancer, infectious diseases, maternity, fracture and orthopædic treatment, and others; to include all normal general services, for example, the family doctor, midwife and nurse, the care of the teeth and of the eyes, the day-to-day care of the child; and to include all necessary drugs and medicines and a wide range of appliances.

(3) To divorce the care of health from questions of personal means or other factors irrelevant to it; to provide the service free of charge (apart from certain possible charges in respect of appliances) and to encourage a new attitude to health—the easier obtaining of advice early, the promotion of good health rather than only the treatment of bad.

2. General Principles to be Observed.

(1) Freedom for people to use or not to use these facilities at their own wish; no compulsion into the new service, either for patient or for doctor; no interference with the making of private arrangements at private cost, if anyone still prefers to do so.

(2) Freedom for people to choose their own medical advisers under the new arrangements as much as they do now; and to continue with their present advisers, if they wish, when the latter take part in the new arrangements.

(3) Freedom for the doctor to pursue his professional methods in his own individual way, and not to be subject to outside clinical interference.

(4) The personal doctor-patient relationship to be preserved, and the whole service founded on the "family doctor" idea.

(5) These principles to be combined with the degree and kind of public organization needed to see that the service is properly provided, for example, to ensure better distribution of resources and to give scope to new methods, such as group practice in health centres.

3. General Method of Organizing the Service.

(1) The maximum use of good existing facilities and experience; no unnecessary uprooting of established services, but the welding together of what is there already, adapting it and adding to it and incorporating it in the larger organization.

(2) The basis to be the creation of a new public responsibility; to make it in future somebody's clear duty to see that all medical facilities are available to all people; the placing of this duty on an organization answerable to the public in the democratic way, while enjoying the fullest expert and professional guidance.

(3) Some temporary limitation of the full service inevitable, for example, in dentistry (owing to insufficient dentists), in ophthalmology and perhaps elsewhere; but the design to be comprehensive from the outset, and to be fulfilled as fast as resources and manpower allow.

(4) The first step to be the making of positive plans for each area of the country, determining what is needed for all people in that area; this to be followed by measures to ensure that what is needed is then secured.

(5) A combination, for all this, of central and local responsibility, to ensure that both general national requirements and varying local requirements are equally met.

4. The Administrative Organization: Central and Local.

(1) *Central.*

(i) Central responsibility to Parliament and the people to lie with the Minister.

(ii) At the side of the Minister, to be a new central and statutory organization for voicing professional views on technical aspects of the service generally; to be known as the Central Health Services Council; to represent general and specialist medical practice, medical teaching, hospital organization and other professional interests; to be appointed by the Minister in consultation with those interests, and to choose its own chairman; to be consultative and not executive; to advise the Minister not only on questions referred to it by the Minister, but also on its own initiative; the Minister to report annually to Parliament on the work of the Council.

(iii) A special executive body to be also set up, composed in the main of members of the medical profession; to be known as the Central Medical Board, and to act under the general direction of the Minister; to be the "employer" body with which the general practitioner enters into contract in the new service, and to concern itself with the distribution and welfare of practitioners and assistants.

(2) *Local.*

(i) Local organization to be based on the county and county borough councils, operating in their normal local government areas where possible, but combining as joint authorities over larger areas where necessary.

(ii) Areas of suitable size and resources for the operation of a full hospital service of all kinds, to be designed by the Minister after consultation with local interests.

(iii) For each of these new hospital areas a joint authority to be constituted, being a combination of the

[1] "A National Health Service", Ministry of Health and Department of Health for Scotland; 1944. London: His Majesty's Stationery Office. 9½" × 6", pp. 85. Price: 1s. net.

existing county and county borough councils in the area; in the few cases where the area may coincide with an existing county area, the authority to be the county council of that area.

(iv) The new joint authority also to be charged with preparing an area plan for the health service as a whole, not only the hospital service, in manner described below.

(v) Existing county and county borough councils, while combining for these duties of the new joint authority, to be responsible severally for local clinic and domiciliary services not belonging to the hospital and consultant sphere, within the general area plan; the responsibility for child welfare to be assigned broadly on the same lines as responsibility for child education. General medical practice to be the subject of special organization, partly local, partly central.

(vi) In each joint authority area, to be a local consultative body for voicing professional guidance on technical aspects of the service; to be known as the Local Health Services Council; to serve a similar purpose locally to the central professional body already described; to advise both the joint authority and the county and county borough councils, and to be free to express advice and views to the Minister.

5. The Planning of the Local Services.

(1) Each joint authority, in consultation with the local professional body referred to and with others locally concerned, to prepare an "area plan" for securing the comprehensive health service for its area; the plan to be based on an assessment of the needs of the area in all branches of the service, to propose how each of those needs should be met, and to be submitted to the Minister.

(2) The Minister to consider each area plan, and any representations made to him by the local professional body or others affected, and to approve the plan with or without modification; the plan, as approved, to be the operative plan for that area; to be the duty of all concerned to provide and maintain their services within the general framework of the plan; the plan to be modified or replaced from time to time, according to requirements, by the same procedure.

6. Provision of the Various Parts of the Service under the Plan.

(1) *Hospital and Consultant Services.*

(i) To be the duty of the joint authorities themselves to secure a complete hospital and consultant service for their area—including sanatoria, isolation, mental health services, and ambulance and ancillary services—in accordance with the approved area plan.

(ii) The joint authorities to do this both by direct provision and by contractual arrangements with voluntary hospitals (or with other joint authorities) as the approved area plan may indicate.

(iii) Powers of present local authorities, in respect of these services, to pass to the joint authority, with all existing hospitals and similar institutions.

(iv) The voluntary hospital system to continue side by side with the publicly provided hospitals; voluntary hospitals to participate, if willing to do so, as autonomous and contracting agencies; if so, to observe the approved area plan and to perform the services for which they contract under that plan, and to receive various service payments.

(v) All hospitals, municipal or voluntary, taking part in the service to observe certain national conditions (for example, as to remuneration of nurses, appointment of consultants); these conditions being centrally prescribed.

(vi) Special provision to be made for inspection of the hospital service, through selected expert personnel (some part time) working in panels over different parts of the country.

(vii) Consultant services to be made available to all, at the hospitals, local centres or clinics, or in the home, as required; to be based on the hospital service, and arranged by the joint authority, either directly or by contract with voluntary hospitals under the approved area plan.

(viii) Measures for improving the distribution of consultants, dealing with methods of appointment and remuneration, and relating this to other branches of the new service generally, to be considered after the report of the Goodenough Committee, but general direction of changes to be: (*a*) Consultants taking part to be remunerated in future (usually by part time or whole time salary) by the particular hospital or hospitals with which they are associated under the area plan; standards of remuneration to be centrally settled in consultation with the profession. (*b*) New arrangements for securing proper standards for consultant appointments in the service, possibly through suitable machinery set up to advise all hospitals making appointments of senior staff.

(2) *General Medical Practice.*

(i) The Minister, with the new Central Medical Board, to undertake nationally the main arrangements for a general practitioner service for the country, through which anyone who wishes to do so can associate himself with a "family doctor" of his own choice and obtain the advice and treatment of that doctor at home or at his present consulting room or at a specially provided and equipped consulting room in a health centre, as the case may be.

(ii) These central and national arrangements to cover terms of service, remuneration of doctors from public funds, and other general aspects of organization, and the individual doctor to be in contract with the Central Medical Board.

(iii) The joint authority in each area to have the duty of: (*a*) including in their area plan an assessment of the needs of their area in general medical practice; (*b*) keeping these needs under review and bringing to the notice of the Minister and the Central Medical Board any general features or requirements of the general practitioner situation in the area which they consider to need attention; (*c*) ensuring that general medical practitioners taking part in the service in the area are acquainted with hospital and consultant and other services available under the area plan, and that they are able (as, under their terms of service, they would be required) to use those services for their patients.

(iv) The county and county borough councils to be responsible for providing, equipping and maintaining such health centres for the conduct of general medical practice in the new service as may be approved from time to time by the Minister in respect of any part of their area, and in such cases to be joined in the doctor's contract with the Central Medical Board.

(v) Future development to include both new methods of "grouped" medical practice in health centres (and, where suitable, outside them) and familiar methods of "separate" practice; each being developed as experience proves best in each area. A high place in the scheme to be given to a full and careful trial of the health centre method.

(vi) Existing practitioners to be able to participate in the new service in their present areas of practice, and where they do so from their own consulting rooms to be normally remunerated on a capitation basis (through other methods to be considered in certain cases if desired by the practitioners themselves). Where they participate in group practice in health centres, remuneration to be by salary or similar alternative.

(vii) Practice in the public service not to debar a doctor from private practice for such patients as may still request this.

(viii) Appropriate limits to be fixed to the number of persons whose care a particular doctor can undertake, taking into due account the extent of private medical practice and the calls made upon a doctor's time by other public appointments; higher limits where assistants are engaged; more regulation of the conditions of the employment of assistants in the service; a requirement that newly qualified doctors shall normally serve a period as assistants before practising on their own account in the new service, and power for the Central Medical Board to require them to give full time to the public service in their early years if necessary.

(ix) New practitioners wishing to participate in the service, and existing practitioners wishing to do so in new areas or new practices, to be required to obtain the consent of the professional Central Medical Board—to check the need for additional public practice in the area, and to ensure a reasonable distribution of resources inside the public service.

(x) Compensation for loss of selling value of practices to be payable where a doctor transfers his public practice into a health centre, or where a public practice falling vacant is not allowed to be refilled by the Central Medical Board.

(xi) Superannuation to be provided for doctors practising at health centres and, if practicable, for doctors participating in the service in other forms of practice.

(xii) The question of the sale and purchase of public medical practices in future to be discussed more fully with the profession.

(3) *Clinic and Other Local Services.*

(i) To be the duty of the joint authority to deal in its area plan with all necessary clinic and other local services (for example, child welfare, ante-natal and post-natal clinics, home nursing, health visiting, midwifery and others), and to provide for the coordination of these services with the other services in the plan.

(ii) Administration of these local clinic and non-hospital services, however, to be normally the responsibility of the individual county and county borough councils which collectively make up the joint authority; the administration to be in accord with the general provisions of the area plan.

(iii) The exact allocation of responsibility between the joint authority and the individual county and county borough councils to be settled in each case by the Minister in determining the area plan; but normally on the principle that services belonging to the hospital and consultant sphere fall to the joint authority, while other local and clinic services fall to the individual councils.

(iv) Child welfare duties always to fall to the authority responsible for child education under the new Education Bill, but to be as much the subject of the "area plan" as any other branch of the service.

(v) New forms of service, for example, for general dentistry and for general care of the eyes, to be considered with the professional and other interests concerned as soon as circumstances allow. In the case of dentistry, the report of the Teviot Committee to be first awaited.

7. The Service in Scotland.

(1) The scope and objects of the service to be the same in Scotland as in England and Wales, and the foregoing proposals to apply generally to both countries—but subject to the differences below.

(2) Certain differences in detailed application in Scotland, due to special circumstances and geography and existing local government structure there; differences mainly affecting the arrangement of responsibility, central and local, for planning and carrying out the service.

(3) Central responsibility to rest with the Secretary of State. A Central Health Services Council and a Central Medical Board to be set up, as in England and Wales, and a local organization appropriate to local needs in Scotland.

(4) Central provision of health centres more suitable in Scotland owing to the smaller size of the problem and the special circumstances of geography and distribution of population—with a power to the Secretary of State to delegate his functions in this respect to a local authority, where found desirable.

8. Financial.

The cost of the comprehensive health service will mainly fall upon central and local public funds. The ways in which it might be shared between the exchequer and the local rates, and other financial aspects of the service generally, are considered in a special financial memorandum.

So far as individual members of the public are concerned, they will be able to obtain medical advice and treatment of every kind entirely without charge except for the cost of certain appliances. They will be paying for medical care in a new way, not by private fee, but partly by an insurance contribution under whatever social insurance scheme is in operation and partly by the ordinary process of central and local taxation. The position in regard to disability benefits, for those ill at home and for those in hospital, will be dealt with in the Government's later proposals on social insurance.

Hospitals in the scheme will, as explained, receive from central funds payments which will include their share of the money representing the social insurance contributions of the public; so far as this is attributable to hospital services. This share can be payable on a bed-unit basis, according to the number of beds put into the service by each hospital under each area plan—except that the share of the voluntary hospitals can, if they wish, be pooled and redistributed in the manner earlier mentioned.

The voluntary hospitals will receive in addition fixed service payments from the new joint authority in respect of all services which they render to the scheme. For the rest, they will meet the costs of their participation in the service out of their normal resources, including charitable subscriptions and donations, on which their voluntary status depends. The position of medical teaching will be specially considered.

The joint authorities will receive from central funds the bed-unit payments which include their share of the social insurance contributions attributable to hospital services. Otherwise their expenses in the service—including their service payments to voluntary hospitals—will be met partly out of rate resources and partly out of central funds. For their rate revenues the joint authorities will depend upon precept upon the counties and county boroughs included in each joint area. The county and county borough councils will receive exchequer aid towards the cost of meeting these precepts and their own expenses in the service.

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on October 13, 1943, at the Children's Hospital, Carlton, Melbourne, DR. HOWARD BOYD GRAHAM, the acting President, in the chair.

Osteoma of the Tibia.

DR. ERIC PRICE showed a boy, aged thirteen years, who was subject to intermittent attacks suggestive of internal derangement of the right knee joint. The child said that periodically, especially whilst he was running, "something would go out" in the right knee. At the same time he would experience pain on the inner side of the knee joint, and this was followed by swelling over the same site. An attack of this nature had occurred three days earlier. On examination, the knee joint itself was normal. There was a bony projection coming from the medial surface of the head of the tibia in relation to the insertion of the overlying tendons. This was surmounted by a circumscribed fluctuant area, taken to be a bursa, which was extremely tender. X-ray examination confirmed the presence of a cancellous osteoma of the upper end of the tibia.

DR. ELIZABETH MCCOMAS said that she had seen the child at the clinic, and her interest had been aroused. She had encountered two similar proved cases and another which probably fell into this category. The first of these patients was a girl, aged twenty-six years, engaged in housework, who complained of locking of the knee at the age of twelve years; the locking at first occurred every two or three months, and later every two or three weeks. The locking took place whilst she was scrubbing, and on rising she could not straighten the knee. Examination revealed that the knee was not locked. Dr. McComas had thought that possibly a cartilage was displaced; X-ray examination, however, revealed a small spike of bone, only half as large as that in Dr. Price's case. The story was not quite typical of cartilage displacement, and the surgeon did not feel disposed to operate. The patient was asked to present herself again when locking occurred. On examination of the patient at that time, the tender spot and the mechanical difficulty appeared to be below the knee joint, and not in it. The case provoked a good deal of discussion at the time. Eventually operation was decided upon. The spike found was so small that there was difficulty in believing that it was the cause of the mischief. However, there were no recurrences after the operation. Dr. McComas said that in the second case she recalled the patient could not straighten the knee after kneeling to pray. This condition recurred frequently. The patient had quite a large exostosis and was operated on by Dr. John Colquhoun, again with success. In the third case, the story was similar and the X-ray examination revealed a small spike of bone, as before. The patient had never been seen with the knee locked, and had never reported back for further treatment.

DR. H. D. STEPHENS said it would not be long before Dr. Price would be seeing many more of these patients. He recalled a boy, aged twelve years, who was training for the high jump at his school sports. He experienced difficulty in jumping and finally was unable to jump at all. X-ray examination revealed a spike of bone similar to that described. Dr. Stephens said he removed the bony spike and the child later won the high jump. Removal of such bony excrescences was not followed by recurrence. Dr. Stephens said he had removed them from the humerus and the tibia without recurrences.

Dr. Price, in reply, said that the case was discussed merely as a cocktail to the main events. He thought it was uncommon. He proposed to remove the osteoma.

Hypertrophy of an Upper Limb.

DR. JEAN MACNAMARA showed a male baby, aged eighteen months. She said that birth had been difficult, labour lasting over two days. The birth weight was seven pounds twelve ounces. The baby was noticed to be pale after his birth. In the maternity hospital the size of his right shoulder and right hand drew comment, and it was not long before his mother noticed that the right hand was unusually large compared with the left. As the child grew, the right hand and forearm increased out of proportion to the rest of the body. The child began to walk unaided at the age of sixteen months. In the right axilla evidence was found of increased circulatory activity. A faint, diffuse nævus was

present over the right scapular region. The child was presented in the hope that someone might give suggestions on prognosis and treatment.

DR. ERIC PRICE said that from time to time he saw a number of these patients. The condition was referred to as hemiatrophy or hemihypertrophy. All possible variations occurred. Both limbs on both sides might be affected, or one limb only, or only part of a limb. He remembered a boy, aged eight years, whose left arm was the size of that of a boy of twelve. This child was the "terror of the school". There was no local cause, nor was there any obvious indication for treatment. Occasionally one leg might require building up. Dr. Price said that in some cases the hypertrophy affected the soft tissues only. These cases were probably lipomatous in nature. In Dr. Macnamara's case, overgrowth of all tissues appeared to be present; this was probably lymphangiomatous. The condition occurred mostly in the upper limb. Dr. Price said he could recall two cases in which the hypertrophy had an angiomatous basis; the first patient had an extensive capillary nævoid affection and the second had a large right leg with a pulsating mass of veins in the groin. Dr. Price said he had incised the mass, intending to ligate the femoral vein, and came upon a honeycomb of thick-walled veins. He succeeded in stopping the pulsation, but the growth of the limb was unaffected.

DR. ROBERT SOUTHBY said that the enlargement was mostly lymphangiomatous, a nævoid element being present over the right scapula. These lesions were commonly hemiplegic in distribution. He had one case in the out-patient department. The patient was a girl, thirteen years old. One arm was involved and a large nævoid swelling was present; the arm was nearly twice the size of the normal arm. The child was referred for deep X-ray therapy, but Dr. Southby had not heard what progress had been made. He wondered whether deep X-ray therapy would be worth while in the present instance.

DR. ALAN MCCUTCHEON said that economic problems were involved. He remembered the case of a girl, aged eighteen years, in whom the swelling was so large as to necessitate extra large pairs of shoes and gloves. Clothes rationing had further increased her difficulties.

Dr. Macnamara, in reply, said that she thought the handicap would be psychological rather than physical. She had tried elevation of the limb at night by splints, but without success. Elastic gloves had proved of little benefit. Her impression was that the right arm was receiving too much food. A vascular network was obvious in the right axilla.

Cirsoid Aneurysm of Arm.

DR. J. W. GRIEVE showed a male child, aged eleven months, with a peculiar abnormality of the hand. The baby was born at term. Delivery was instrumental and the birth weight was six pounds thirteen ounces. At six months the left hand was black, especially the index and second fingers. Pulsation was visible at the time. Recently the arm had become bigger, and pulsation was detectable in the vessels of the forearm, arm and axilla. The left hand was noticed to be warm. A systolic murmur was audible over the precordium. A similar murmur was audible over the dilated vessels in the arm. Dr. Colin Macdonald had reported an increase in the size of the upper mediastinal shadow in the X-ray film of the heart. Dr. Grieve said he would appreciate an expression of opinion on diagnosis and treatment. He had not previously seen anything quite like the condition. He thought the probable diagnosis was congenital cirsoid aneurysm.

DR. ERIC PRICE said that in this case they were dealing not only with an angiomatous swelling, but with enlargement of the skeleton. It would be worth while considering ligation as far proximally as possible. There appeared to be the possibility or certainty of an arterio-venous communication, which would furnish an explanation of the hypertrophy of the cardiac shadow.

DR. H. BOYD GRAHAM forecast the development of discoloration in the affected arm. He remembered a case in which Dr. Coates had demonstrated the communication and had operated, bringing about improvement, though not cure. Apparently multiple anomalies existed in such cases, and so complete remedy was impossible. The German school held a theory that the cause of the condition was the imperfect fusion of twins; but this was far-fetched. It might explain the skeletal enlargement, but not the interference with the soft tissue growth. The increased size might well be ascribed to the extra nourishment brought about by the increased blood supply. The problem was almost insoluble.

Dr. Grieve, in reply, said that in Dr. Macnamara's case the X-ray film revealed no bony enlargement, and therefore he thought that deep X-ray therapy might help, as the condition was apparently lymphangiomatous. With regard to his own case, he thought it should be classified as a cirsoid aneurysm.

(To be continued.)

Correspondence.

HERPES ZOSTER AND CHICKENPOX.

SIR: The association of *herpes zoster* and chickenpox is frequently mentioned in literature, but I am unable to find any record of the former apparently causing a localized immunity of the latter.

N.B., *ætatis* about forty-five, consulted me with supra-orbital *herpes zoster* on his right forehead. Three days after he 'phoned to say he had a rash all over him composed of tiny blisters. On the following day there was a well-marked right supraorbital herpes, also a profuse generalized chickenpox rash, except for his left forehead, which was perfectly clean.

As *herpes zoster* is rarely bilateral, did this condition cause an immunity to the chickenpox on the opposite side?

Yours, etc.,

K. C. GODFREY.

92, Thomas Street,
West Perth,
April 6, 1944.

HOOKWORM INFESTATION.

SIR: The relative values of hexyl resorcinol, oil of chenopodium, carbon tetrachloride and tetrachlorethylene in hookworm treatment have been established for so many years as the result of work by numerous well-known investigators, who formed their conclusions on many thousands of treatments, that it is surprising to find a report on the treatment of 386 very mild cases divided into six groups, put forward as a pronouncement on the comparative value of these drugs, without any reference to previous work. I refer to a paper entitled "Hookworm Infestation" by Major Lowe and Major Lancaster in THE MEDICAL JOURNAL OF AUSTRALIA of April 1.

If one or two individuals choose to ignore published and well-authenticated evidence of the value of any form of treatment, decide to begin *de novo* and find out for themselves, it is their own affair. If the matter were to rest at that there would be no grounds for criticism, but in the paragraphs of the above paper, under the heading "Toxic Effects of the Drugs Used", there lies a danger that the medical man unfamiliar with the subject might be led to accept these brief remarks as a full statement of the position. The writers say that in 317 instances of the use of carbon tetrachloride they had two cases with jaundice and two with pain and tenderness in the hepatic region, and as they make no comment on this evidence of liver damage nor describe any combative treatment, it seems that they cannot be aware of the grave import of these signs and symptoms. Their conclusion is that this evidence of toxicity indicates that the maximum dose compatible with safety (three cubic centimetres) has been used.

The facts are that carbon tetrachloride is a dangerous drug and its toxicity is largely independent of the size of dose. For instance, if my memory serves me, the late Maurice Hall, the noted American veterinary authority, took seven cubic centimetres without ill effects before he recommended it to the medical profession as an anthelminthic, and there is a record of death following a dose of 1·5 cubic centimetres. The reasons for this variation in toxicity have been extensively studied, and it has been found to depend on certain other factors such as association with alcohol and the nutritional state of the individual. All the available evidence goes to show that carbon tetrachloride always causes damage to the liver, whether signs and symptoms occur or not.

Carbon tetrachloride filled an important place in hookworm treatment at one stage in its evolution, and in spite of its drawbacks was the best drug at our disposal for a number of years, but on account of the need for precautions in its use and the relatively numerous fatalities it has caused, it is now rarely employed in hookworm treatment by anyone familiar with the subject. It has been almost wholly superseded by tetrachlorethylene since it has been demon-

strated that the latter has approximately the same anthelminthic value against hookworms as carbon tetrachloride, and that it does not damage the liver. Both these drugs cause transient symptoms generally ascribed to diffusible stimulants, and although no deaths have yet been reported from tetrachlorethylene, there are records of at least four cases showing deep narcosis, similar to chloroform anæsthesia and lasting for two or more hours, thus indicating that patients should be kept under observation for some hours after swallowing the drug.

Yours, etc.,

Lachlan Park Hospital, New Norfolk, Tasmania. April 11, 1944.

PHILIP A. MAPLESTONE.

LIQUOR REFORM.

SIR: I recently received a folder from the Queensland Liquor Reform Society. It has among its office-bearers leaders in every profession and in every kind of public body, from the President of the Queensland Branch of the British Medical Association to the past president of the Real Estate Institute, from the President of the New Education Fellowship to the President of the Returned Soldiers, Sailors and Airmen's Imperial League of Australia, from the Trades and Labour Council to the Royal Automobile Club.

It is interesting to note that the Liquor Trades Employees' Union is represented, but that the brewers and hotel-keepers are not.

The reforms suggested are entirely sane and seem to be very necessary. The society advocates that the liquor industry in each State should be controlled by a commission, responsible to Parliament as a whole, composed of representatives from the following professions and organizations: commercial, medical, educational, trade unions, manufacturers and distributors of alcoholic beverages, women's organizations, with a Supreme Court judge as chairman.

It recommends that spirits and fortified wines should be rationed, the sale of low-grade and immature fortified wines forbidden, and the production of light table wines encouraged.

It also recommends that the alcoholic content of beer be reduced from 8% or 9% to 5%, which is about the strength of light beers in other countries.

It suggests that grape and other fruit juices should be popularized, and that the conditions under which alcohol is drunk should be improved: that the closed bar, with its trough-like drinking habits, should be abolished, and that all drinks should be served at tables in pleasant surroundings, where light refreshments should be available.

With these reforms could come a reconsideration of hours, and the ending of the against-the-clock guzzle just before six.

I am told that the Queensland Branch of the British Medical Association is cooperating with the society, once more showing a social conscience that is an example to other Branches.

Yours, etc.,

Katoomba, New South Wales, April 10, 1944.

E. P. DARK.

Obituary.

EDGAR WINN FOX DOLMAN.

WE regret to announce the death of Dr. Edgar Winn Fox Dolman, which occurred on March 14, 1944, at Brisbane.

Nominations and Elections.

THE undermentioned has applied for election as a member of the New South Wales Branch of the British Medical Association:

Yeates, James Macrae, M.B., 1935 (Univ. Sydney), 41, Hill Street, Toowoomba, Queensland.

The undermentioned have been elected as members of the New South Wales Branch of the British Medical Association:

Barrie, Ian Reynolds, M.B., B.S., 1940 (Univ. Sydney), 2, Derby Street, Vaucluse.

Geddes, Bruce Lyne, M.B., B.S., 1943 (Univ. Sydney), 10, Hale Road, Mosman.

Saunders, Gladys Marie, M.B., B.S., 1939 (Univ. Melbourne), The Rectory, Tarcutta.

Tripp, Jeffery Robert, M.B., B.S., 1943 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Diary for the Month.

APR. 26.—Victorian Branch, B.M.A.: Council Meeting.
APR. 27.—New South Wales Branch, B.M.A.: Branch Meeting.
APR. 28.—Queensland Branch, B.M.A.: Council Meeting.
MAY 2.—New South Wales Branch, B.M.A.: Organization and Science Committee.
MAY 3.—Victorian Branch, B.M.A.: Branch Meeting.
MAY 3.—Western Australian Branch, B.M.A.: Council Meeting.
MAY 5.—Queensland Branch, B.M.A.: Branch Meeting.
MAY 5.—Victorian Branch, B.M.A.: Legislative Subcommittee.
MAY 9.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
MAY 9.—Tasmanian Branch, B.M.A.: Branch Meeting.
MAY 12.—Queensland Branch, B.M.A.: Council Meeting.
MAY 12.—Victorian Branch, B.M.A.: Ethics Subcommittee.
MAY 15.—Victorian Branch, B.M.A.: Hospital Subcommittee.
MAY 15.—Victorian Branch, B.M.A.: Finance Subcommittee.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia.

Editorial Notices.

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